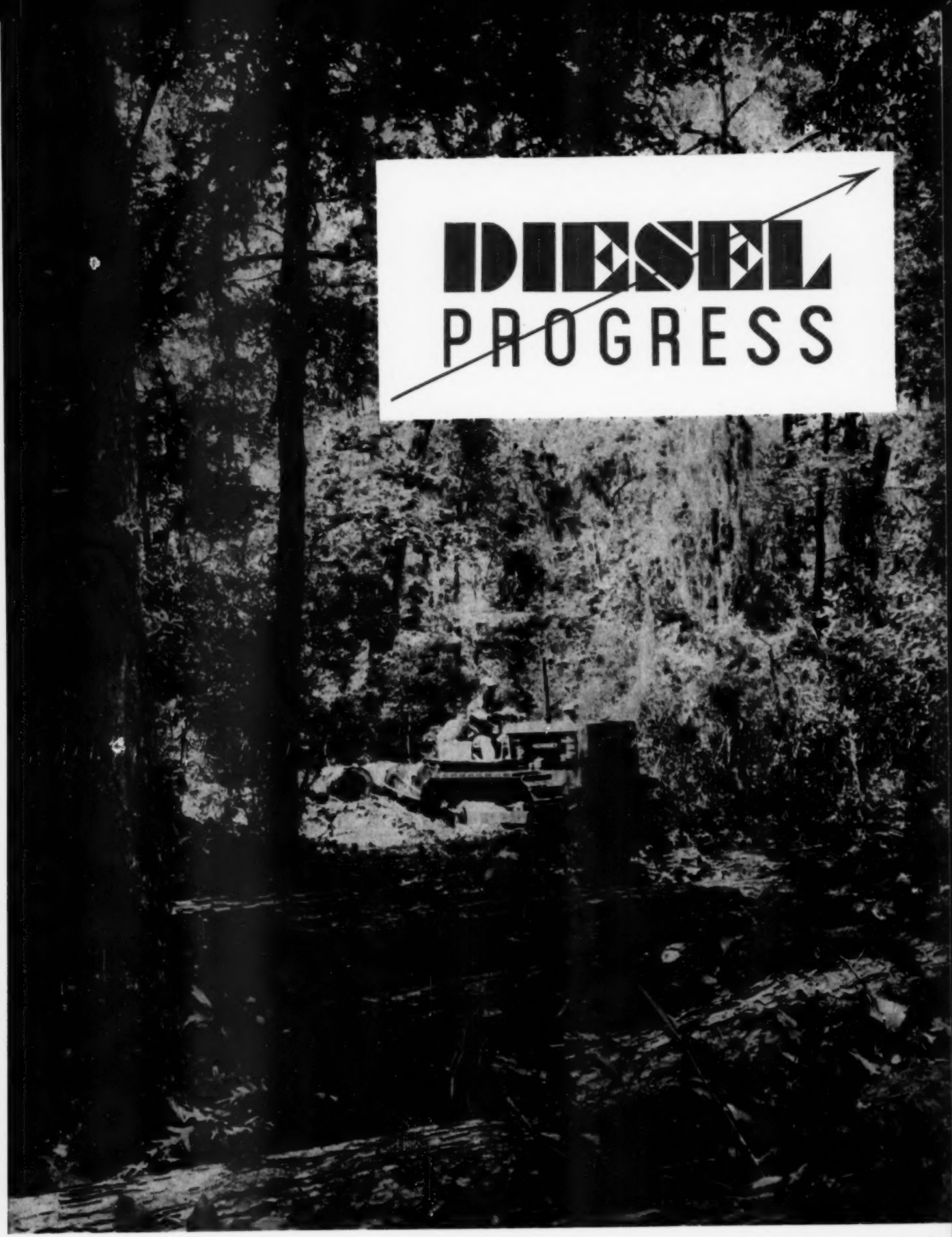

DIESEL PROGRESS

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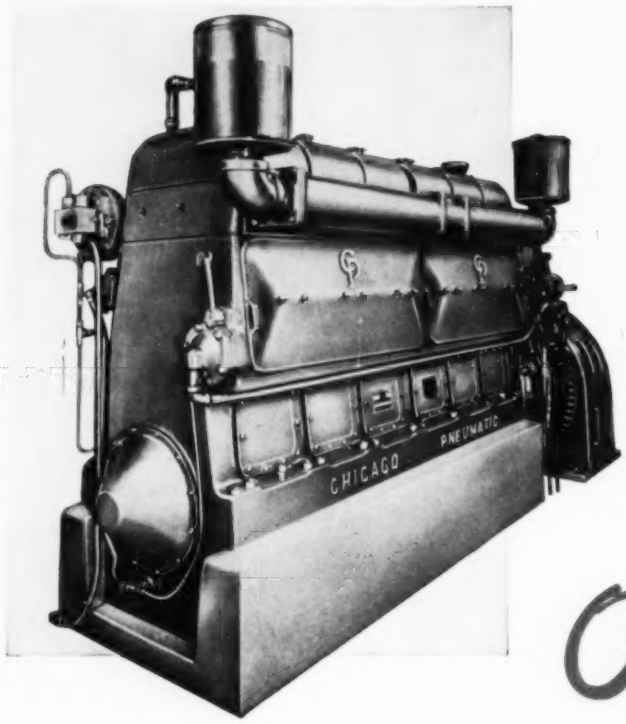

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Save on maintenance and fuel consumption by lubricating with Texaco Ursa Oils

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Texaco Ursa Oils maintain their protective lubricating films under high heat and pressure. They fight off oxidation and the formation of carbon, gum and sludge . . . assure longer life for bearings, pistons, rings and cylinder liners.

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More stationary Diesel hp. in the U.S. is lubricated with Texaco Ursa Oils than with any other brand.

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FOR ALL DIESEL ENGINES

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DIESEL PROGRESS, for May, 1949. Volume XV, Number 5. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 W. Forty-fifth St., New York 19, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at East Stroudsburg, Pa., authorized Mar. 27, 1940. Subscription rates: $5 per year, single copy 50c.

IN HARBOR TOWING...

HARBORMASTERS can save 23% operating time over inboard towing equipment!

Operating facts prove the efficiency and economy of the illustrated Model O-6 (165 h.p. Diesel) harbor towboat. The owner's own figures for a full year's heavy-duty service showed him a 23% saving in operating time, compared with an inboard powered towboat of the same horsepower in the same service.

IN RIVER TOWING...

HARBORMASTERS can move more tonnage in less time.

This Harbormaster towboat, now in its fourth year of service, replaced a towboat with inboard Diesel power and rudder steering, on the Berbice River in British Guiana. On this run the inboard towboat was handling 4.8 tons of payload per horsepower. This boat handles 6.1 tons of payload per horsepower, an increase of 27%. The average trip time of the inboard boat was 35 hours; of this boat, 30½ hours, a decrease of 12½%.

FOR TOW BOOSTERS...

HARBORMASTERS can save, after taxes, on reduced running speed alone, enough to repay the original investment in 18 months!

Two remote-controlled Model O-72 300 h.p. Diesel Harbormasters, installed on the stern barges of this 18,000 to 20,000 ton tow, increased its running speed .75 miles per hour. This saving alone, after taxes, amounted to enough to repay the investment in 18 months, according to the customer's figures. The saving on double-tripping eliminated at the same time is additional.

FOR IMPROVED CONTROL...

HARBORMASTERS can increase the total number of trips per season by nearly 50%!

In river and canal operating particularly, improved control offers surprising opportunities for savings. Rudders absorb power. Locking wastes time if full control is lacking. One Model O-62 Harbormaster was installed on the integrated tow "Carutica", shown here, to provide control through propeller-thrust steering. 26 round trips were completed the first season, against a previous average of 18.

These examples and others, all different, all lead to the same conclusion. Heavy-duty outboard propulsion with propeller-thrust steering, can be a more efficient, more economical system than inboard power with rudders. If you are engaged in marine transportation, there is an excellent possibility that Harbormaster equipment can reduce your costs and increase your profits.

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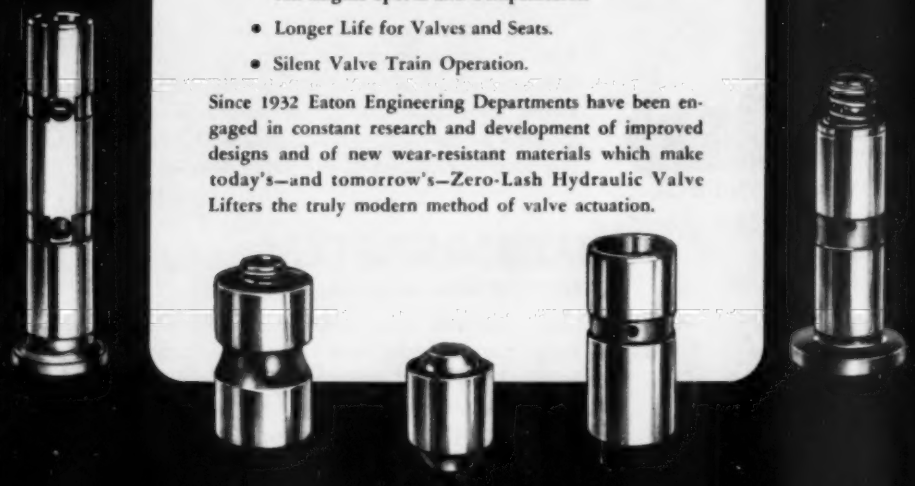
Since 1932 Eaton Engineering Departments have been engaged in constant research and development of improved designs and of new wear-resistant materials which make today's—and tomorrow's—Zero-Lash Hydraulic Valve Lifters the truly modern method of valve actuation.



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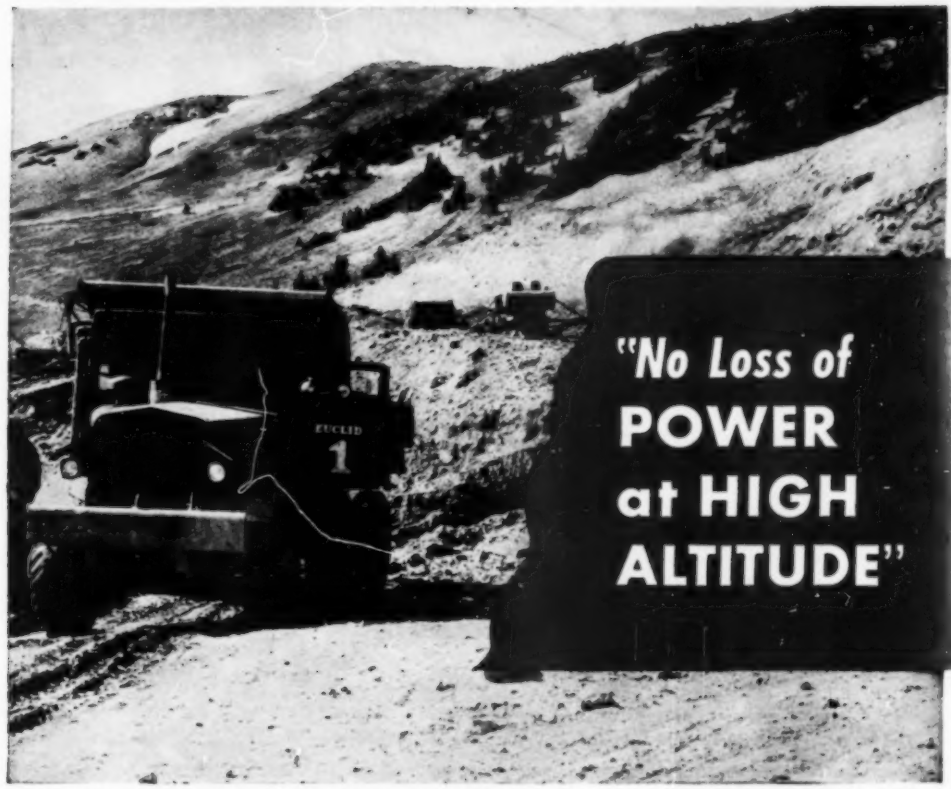

THAT'S what drivers for The McLaren Gold Mines Co., Cooke, Montana say of the General Motors Diesels powering their Euclid dump trucks. And they're speaking from really rugged experience.

The mine is at an altitude of 9600 feet. On a haul of 4½ miles over grades as steep as 16%—these trucks make 8 round trips per 9-hour shift. They work without a whimper—18 hours a day, 7 days a week.

GM Diesels are especially well suited to high-altitude operation because of their 2-cycle design. With power at every piston downstroke, they deliver twice the number of power impulses for each turn of the shaft. A built-in blower provides pressurized "Uniflow" scavenging which assures cleaner, more complete combustion. This gives them plenty of tough, fast-stepping horsepower that's quick to respond to a touch of the throttle.

No matter what your requirements may be, if you want sturdy, money-making power, be sure to look into General Motors Series 71 Diesel engines.

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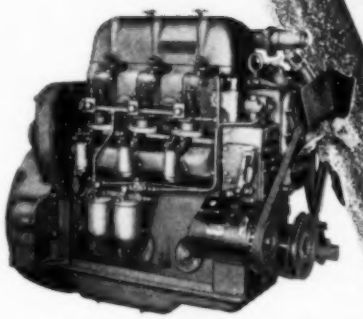

Model 387-C. 3 cylinder — 2 cycle.

Model 687-C. 6 cylinder — 2 cycle.

• The cylinder head and liner assemblies in P&H Diesels are independent — *removable as a unit* — interchangeable on all models.

This P&H patented feature, exclusive in the field of diesel engines, simplifies maintenance problems and reduces servicing time to a new low.

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Longer cylinder life is provided with liners of alloy steel, *hardened* for maximum resistance to wear. Air inlet parts, machined on a compound angle, impart a strong spiral motion which promotes thorough scavenging and assures complete combustion.

Literature on request. Address Harnischfeger Corporation, Diesel Division, Port Washington, Wis.

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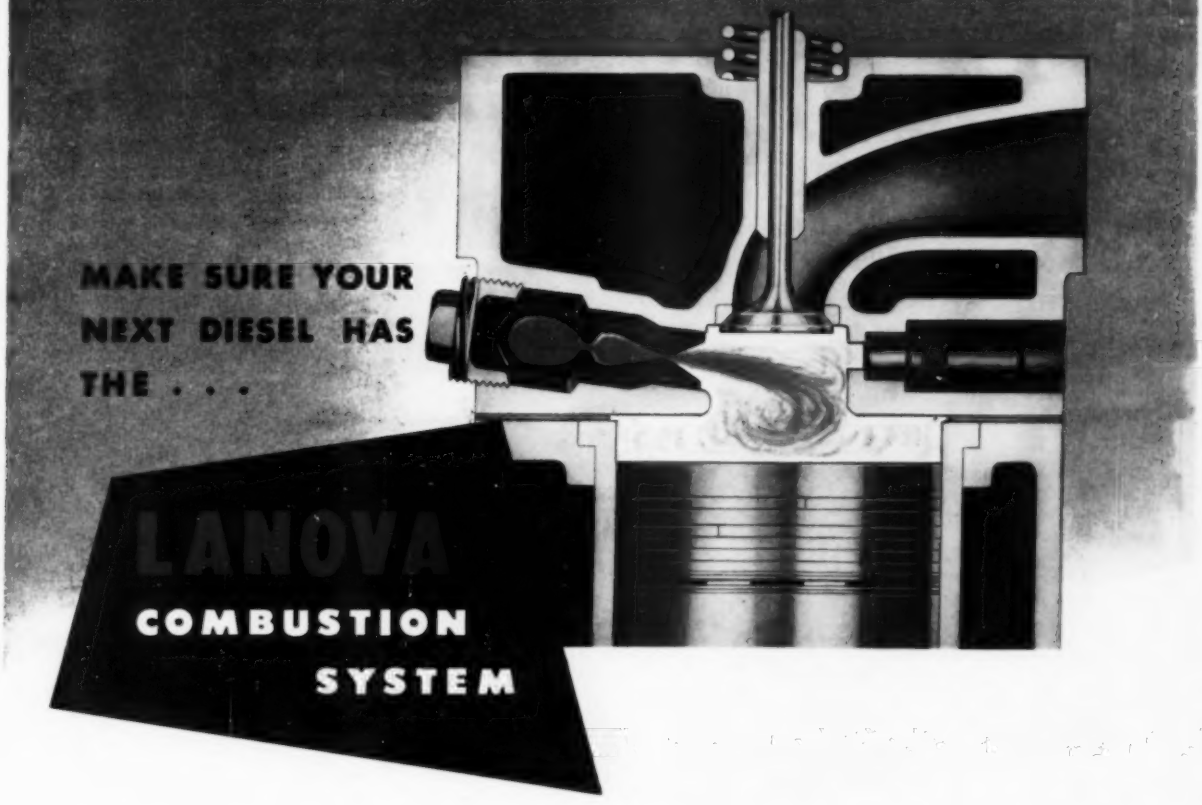

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THERE'S plenty of smooth flowing power packed in Diesels that use the Lanova Combustion System. They're famous for their ability to give prolonged availability with little or no maintenance or repairs.

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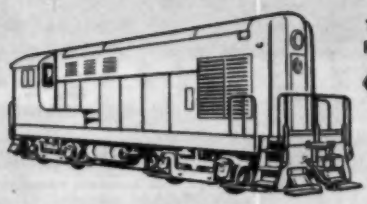
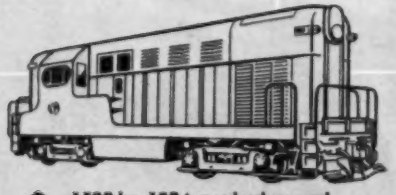
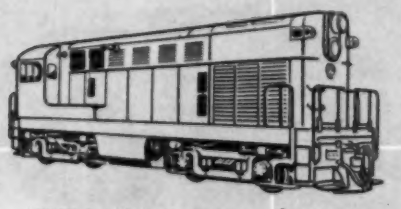
LANOVA *makes Diesels purr*



1000 hp. 120 ton switching locomotive



1500 hp. 120 ton suburban and general purpose locomotive



2000 hp. 125 ton heavy duty locomotive

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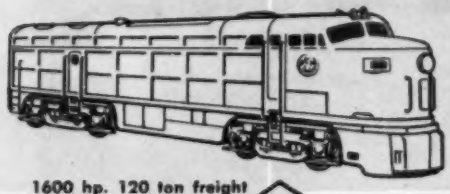
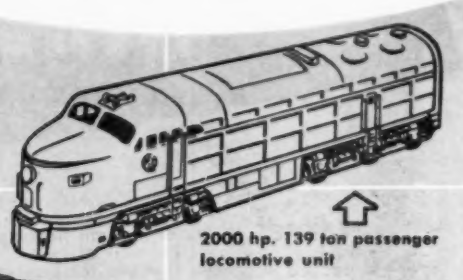
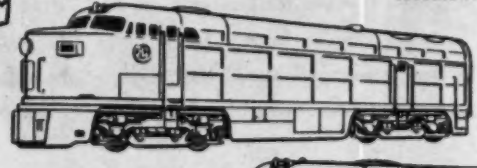


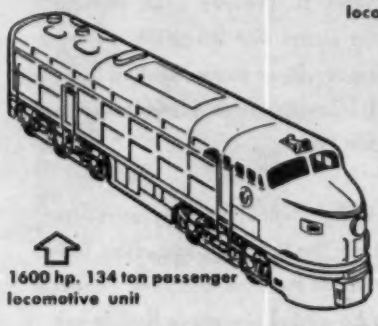
1600 hp. 120 ton freight locomotive unit



2000 hp. 139 ton passenger locomotive unit

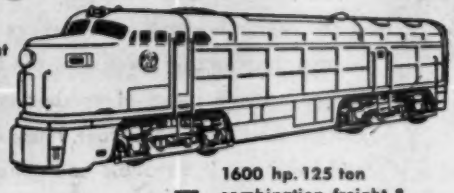
2000 hp. 123 ton freight locomotive unit



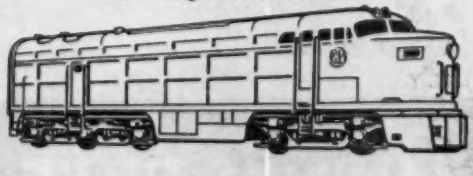


1600 hp. 134 ton passenger locomotive unit

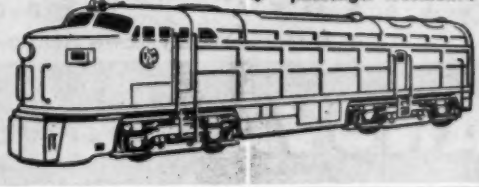
2400 hp. 126 ton freight locomotive unit



2400 hp. 142 ton passenger locomotive unit



1600 hp. 125 ton combination freight & passenger locomotive unit



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COMPLETE TESTING LABORATORIES

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HARRISON

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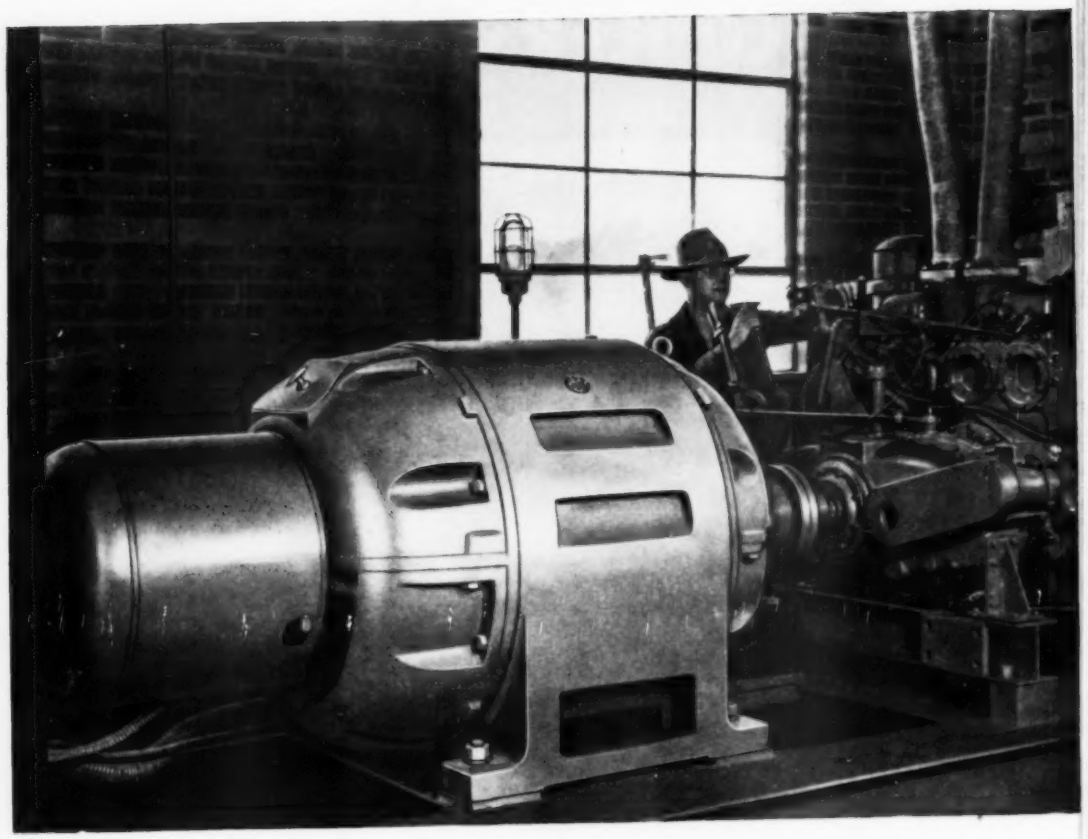

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Beaumont Buys General Electric

TRI-CLAD Synchronous Generators

The City of Beaumont, Texas, had a problem when they installed a standby power plant for their water plant. A diesel-driven generator was chosen for efficiency and operating economy. But the new plant had to be compact—it was installed in an existing building with no special foundations and low headroom. The plant had to operate dependably with a minimum of attention and maintenance.

Electrically, the Tri-Clad high-speed synchronous generator gave all the right answers. Smooth contours and a compact frame are external evidence of a complete redesign. Tri-Clad high-speed synchronous generators incorporate the convenience and protection features of the industry-proved Tri-Clad induction motors. You get extra protection and convenience plus smooth, attractive appearance when you couple Tri-Clad high-speed synchronous generators to your diesels.

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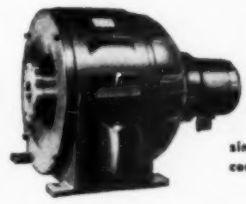
YOU GET VERSATILITY, TOO! There are modifications to fit every requirement:

standard generator for direct-coupling, belt- or chain-drive

top-mounted exciters



single-bearing direct-coupled generator

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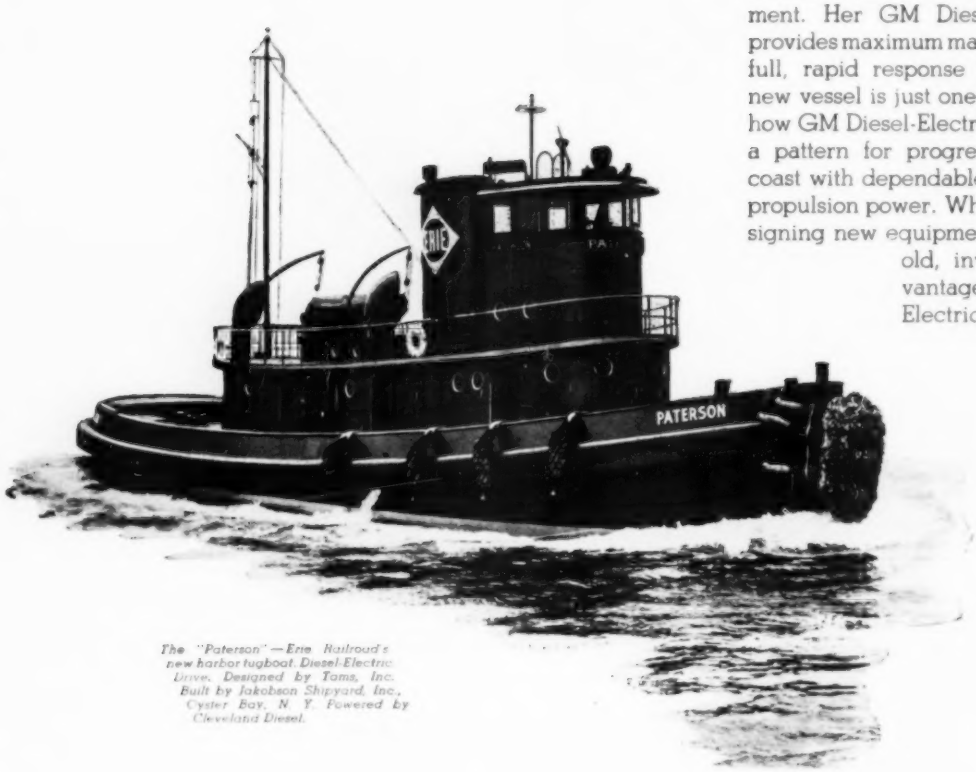
Modern power

for a Modern Railroad

It's General Motors Diesel-Electric Drive for the "Paterson"—Erie Railroad's newest harbor tugboat. Designed to handle car floats in crowded New York Harbor, the "Paterson" embodies the latest advances in tugboat equipment. Her GM Diesel-Electric Drive provides maximum maneuverability and full, rapid response to controls. This new vessel is just one more example of how GM Diesel-Electric Drive is setting a pattern for progress from coast to coast with dependable, highly efficient propulsion power. Whether you are designing new equipment or repowering old, investigate the advantages of GM Diesel-Electric Drive—it pays!



The "Paterson"—Erie Railroad's new harbor tugboat. Diesel-Electric Drive. Designed by Tams, Inc. Built by Jakobson Shipyard, Inc., Oyster Bay, N. Y. Powered by Cleveland Diesel.

Leader in Diesel engineering development for 37 years

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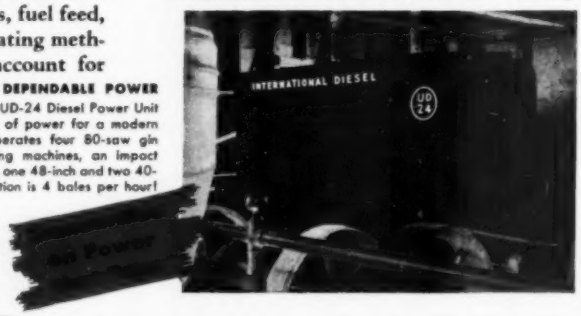
- ***PERFORMANCE***

GOOD MEDICINE

Just what the doctor ordered . . . *red-painted* International Diesels keep balance sheets healthy by boosting production and guarding costs. They deliver their full-rated horsepower on every job, yet hold in reserve additional lugging ability for handling sudden overloads that would otherwise kill. ● Their starting and combustion systems, fuel feed, speed governing, torque control, lubricating methods and overall rugged construction account for their superior performance and long-lived stamina. ● Since reliable, economical power is "good medicine" for any power-using business, it will pay you to contact your International Power Unit Dealer and get International Diesels on your operations now.

INTERNATIONAL HARVESTER COMPANY • Chicago



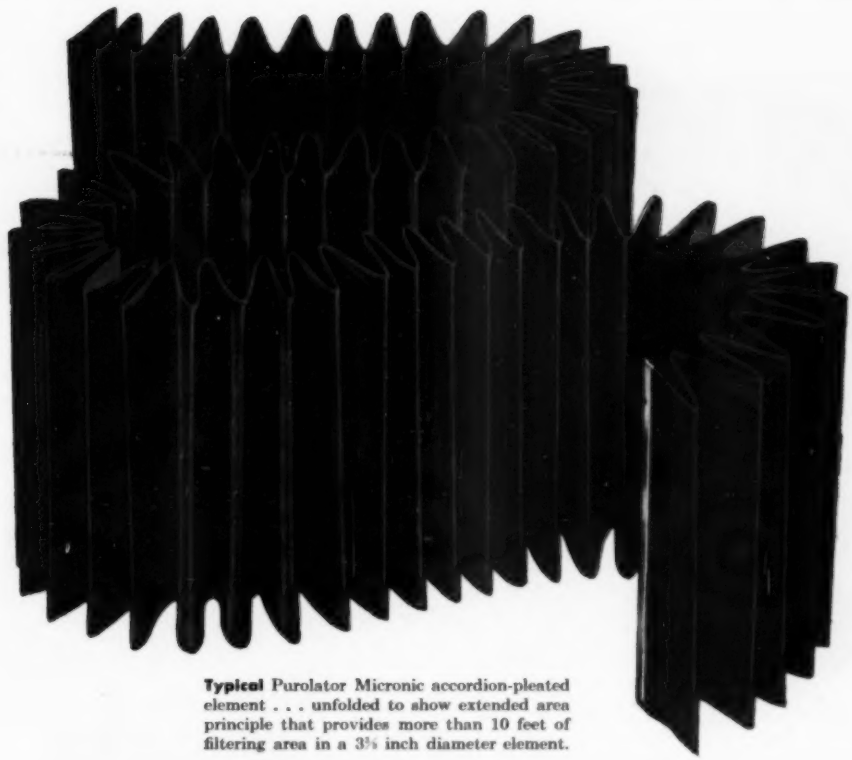
ECONOMICAL, DEPENDABLE POWER
This International UD-24 Diesel Power Unit is the sole source of power for a modern cotton gin. It operates four 80-saw gin stands, two balling machines, an impact cleaner and drier, one 48-inch and two 40-inch fans. Production is 4 bales per hour!

Listen to James Melton and "Harvest of Stars" every Sunday, NBC.

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

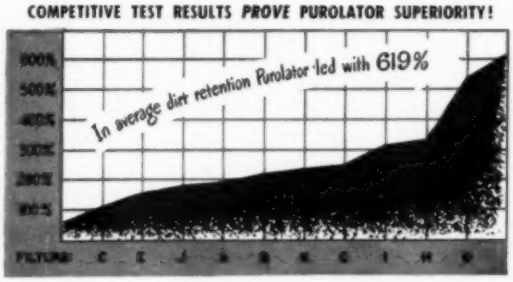


Typical Purolator Micronic accordion-pleated element . . . unfolded to show extended area principle that provides more than 10 feet of filtering area in a 3⅝ inch diameter element.

Sidetracks over 200% more abrasives...

because it filters *micronic* particles—has 5 times greater filtering surface

COMPETITIVE TEST RESULTS *PROVE* PUROLATOR SUPERIORITY!



PUROLATOR
MICRONIC OIL FILTER

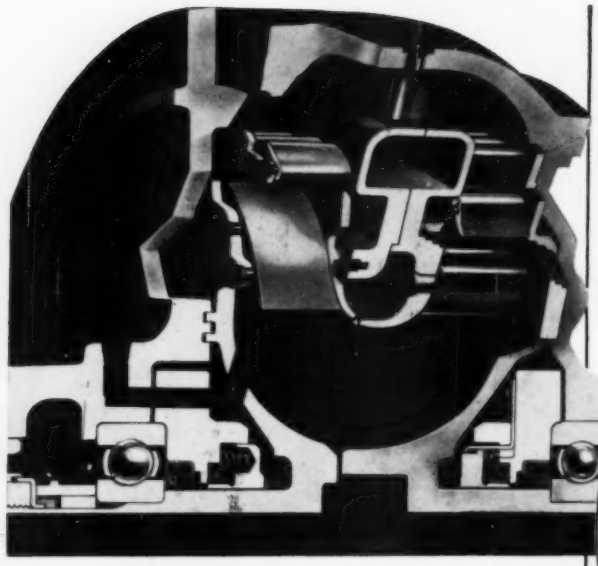
This revolutionary accordion-pleated *micronic* element explains why you give Diesels *greater* protection from abrasives when you specify a Purolator Micronic Filter.

And better protected Diesels *last longer* . . . require *less time off* the job for maintenance.

For *fuel oil* filtration, Purolator does the *complete* job so vital because of close tolerances of injector plungers—and the microscopic smallness of injector tip orifices. And for *lubrication oil* filtration, Purolator's greater efficiency assures less wear on hard-working bearings.

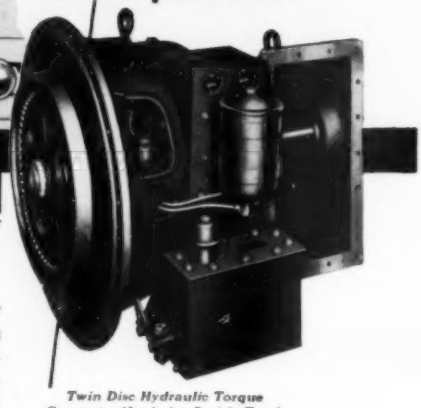
Let us show you how the Purolator Micronic Refill can lengthen life . . . reduce upkeep . . . for *your* Diesels regardless of their type, or the make of original filter. And let our highly experienced engineering staff help you with any special filtering problem you may have.

PUROLATOR PRODUCTS INC.,
Newark 2, New Jersey and Windsor, Ontario, Canada



Sectioned view of Twin Disc Hydraulic Torque Converter

Greatest Overall TORQUE Multiplication



Twin Disc Hydraulic Torque Converter (Lysholm-Smith Type)

When considering power transmission units for equipment with high torque demands, designers turn naturally to Twin Disc's Lysholm-Smith Hydraulic Torque Converter, because it offers the greatest overall torque multiplication of any unit made today.

The hydraulic circuit of Twin Disc's Converter consists of a centrifugal pump discharging through a *three-stage* turbine, with two reaction stages interposed between the turbine stages. Maximum torque is developed at output shaft stall and is approximately five times engine torque . . . maximum efficiency is attained at an output speed ratio of approximately .5.

To apply a Twin Disc Torque Converter to any engine and machine assembly, it is necessary to select a converter with a proper pump size to absorb engine hp over its complete operating range. The drive ratios in the machine must be properly selected to obtain maximum converter performance throughout the complete range of output shaft operating speed.

The Twin Disc Hydraulic Division offers assistance in solving your power transmission problems. Torque Converter models are currently available with horsepower ratings from 50 to 600 hp. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Worthington Gas-Diesel Engine Pays For Itself Fast, By Cutting City's Power Costs

In March, 1948, the Municipal Power Plant of Lafayette, La., installed this Worthington Engine — a Type SEHPG, Twin-Six, Supercharged Gas-Diesel. Supplementing previously installed Oil-Diesel equipment of various makes and sizes, the new Worthington has won unqualified praise for outstanding economy and dependability. Chief Engineer R. P. Hebert states:

"Cost of generating power with our Worthington Gas-Diesel is 2½ mils per kw-hour. Our Oil-Diesel fuel cost is 9 mils per kw-hour. We are saving about $5,000 a month and figure the installation will pay for itself in about three years.

"Next to low fuel costs, as compared to the other units, the most remarkable feature of our Worthington Gas-Diesel is its low lube oil consumption. Estimates were 4,000 bhp per hr for each gallon of lube oil. Actually, we have been getting around 10,000 bhp per gallon.

"Maintenance cost on the Worthington has been low during steady operation."

Prime Movers... And Prime Savers

Worthington Diesels cover the entire range of municipal and industrial applications . . . It will pay you to get further facts on how they can meet your own particular requirements with the cost-saving, trouble-free performance that proves *there's more worth in Worthington.*

Write, stating your problems, to *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

EO-3

WORTHINGTON

YOUR PARTNER IN POWER PROGRESS

Diesel engines, 150 to 2,640 hp . . . gas engines, 175 to 1,720 hp . . . dual fuel engines, 225 to 2,640 hp.

WORTHINGTON-BUILT AUXILIARIES

Balanced Angle Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler

FOR

Coordinated CONTROL

USE PRE-ENGINEERED GENERATOR SWITCHGEAR

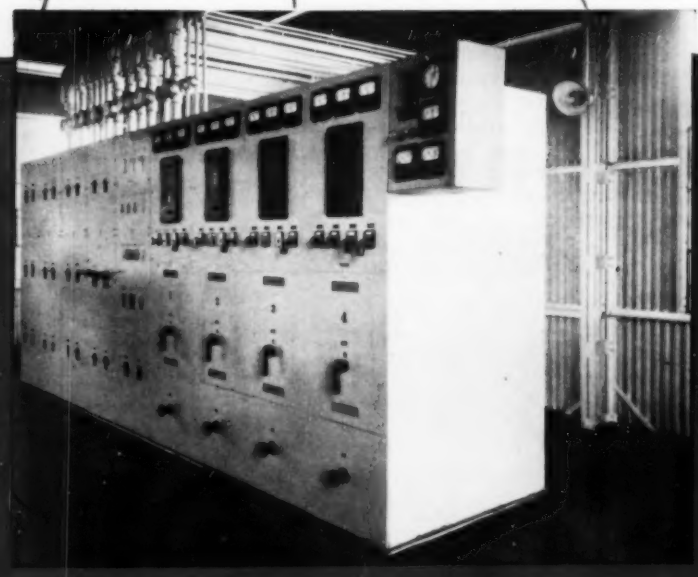
High-Voltage E-M Switchgear in a Power Plant—Shown are two generator panels for 2400 volt generators, five feeder panels and a swing panel.

● Here, in a conveniently packaged, easy-to-buy unit, is switchgear that gives integrated, coordinated control of engine-driven generators.

E-M generator switchgear is pre-engineered to simplify selection. All component parts are of the exact size and type needed for the trouble-free operation of the individual installation. You can rely on the experience of E-M switchgear experts and on the manufacturing methods perfected through a half-century of specializing in big electric power apparatus.

Of uniformly attractive appearance, and built for high or low voltage requirements, E-M generator switchgear is readily adaptable for the addition of new panels as new generators are added to your plant. For full information, talk to your nearest E-M field engineer or write to us.

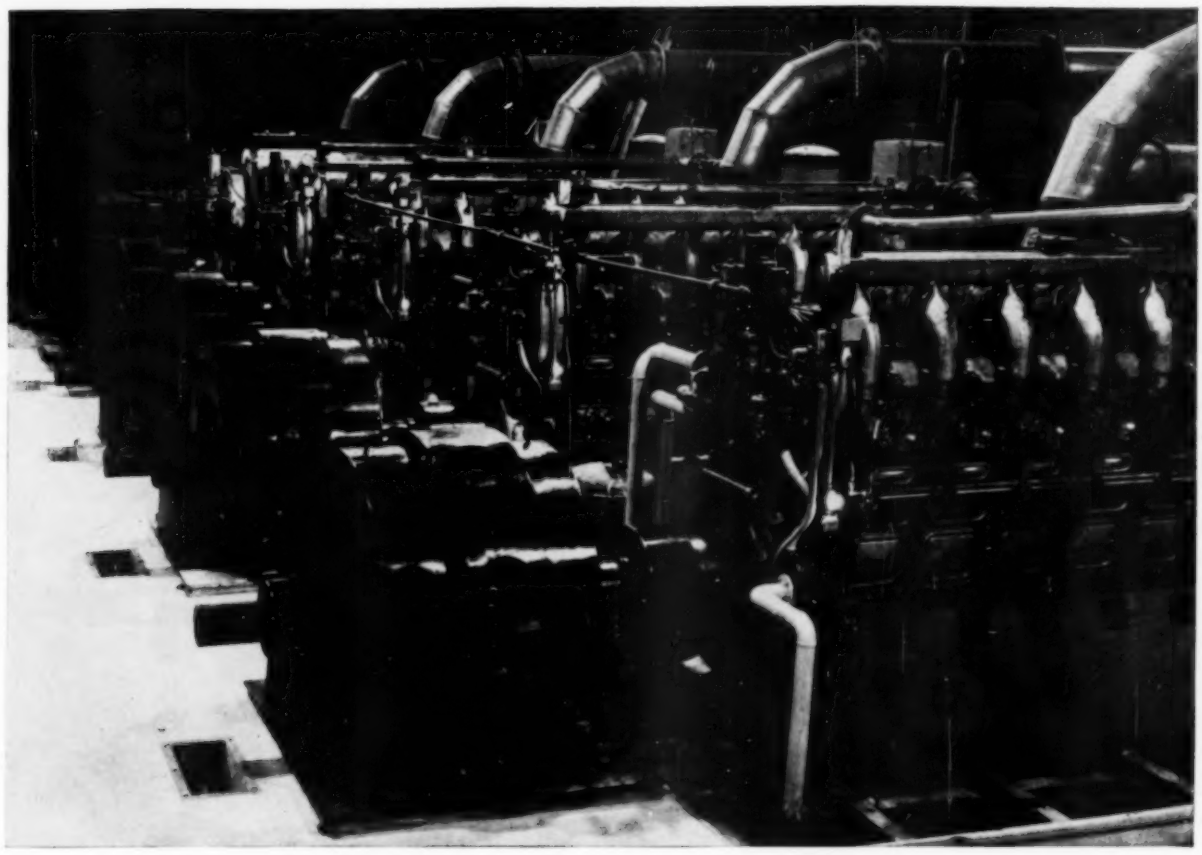
ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA



SERVING THE OIL INDUSTRY
An Example of E-M Low-Voltage Switchgear Installation

● In this installation at the Magnolia Petroleum Company are four generator panels for 375 kva, 400 rpm, 480 volt generators, five feeder panels, and a swing panel for synchronizing equipment and with provision for a totalizing watt-hour meter.

E-M



Utility company gets reliable power ...fast!

A UTILITY COMPANY needed an immediate and reliable source of electrical power. Five marine-type Diesels were purchased, rebuilt for stationary service, and put into operation... all in a few months.

These engines, shown above, were manufactured by the Cleveland Diesel Division of the General Motors Corporation. Each has 16 cylinders, a rating of 1600 HP, an operating speed of 750 RPM.

The new plant has run at near capacity for almost a year. Despite this taxing service, power output has been reliable and constant. An important factor in the successful operation of these Diesels has been the use of Nonpareil HD Diesel Oil. Inspections show that the engines have been well protected against wear and deposits. Five more of these units are being installed and will likewise be protected by Nonpareil HD.

NONPAREIL HD DIESEL OIL

Why risk trouble in your Diesels? Whatever the type of engine or however severe the operation, Nonpareil HD Diesel Oil will help you get highest Diesel economy and reliability. This truly heavy-duty lubricant owes its superiority to the combination of effective oxidation-resistant and detergent additives with highest-quality base stocks.

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Oil Lubrication Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD

2-cycle
21½" bore
27½" stroke

This is Lima-Hamilton's DUAL-FUEL ENGINE

- **with fast, easy change-over from gas to oil and oil to gas**
- **for operation on low-pressure gas with extremely low pilot-fuel requirements**
- **455 hp per cylinder at 257 rpm, in sizes of 5 to 10 cylinders.**

This engine is, we believe, the first large two-cycle, loop-scavenging engine to work satisfactorily on the low-pressure gas-injection principle.

Excellent fuel economy is experienced with this engine throughout the complete load range. Combustion of fuel under all loads is complete and extremely quiet. Pilot-fuel requirements are unusually low.

When arranged for dual-fuel operation, the engine is rated at 455 hp per cylinder at 257 rpm, whether running on gas or oil. This is a net rating at 100% load, and includes blower requirements. In performance, maintenance and control, no perceptible difference can be found between dual fuel and straight diesel operation.

* * *

We are pleased to present this engine as another example of the results of Lima-Hamilton's progressive research and engineering policies. For prompt, specific answers to all questions, write directly to Lima-Hamilton Corporation, Hamilton, Ohio.

LIMA HAMILTON CORPORATION

DIVISIONS: *Hamilton, Ohio*—Hooven, Owens, Rentschler Co.; Niles Tool Works Co. *Lima, Ohio* — Lima Locomotive Works Division; Lima Shovel and Crane Division. *Middletown, Ohio* — United Welding Co.

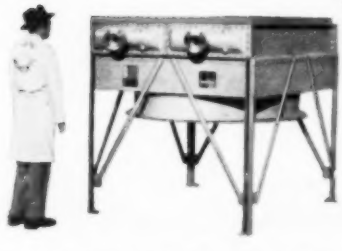
PRINCIPAL PRODUCTS: Hamilton diesel and steam engines; Hamilton-Kruse automatic can-making machinery; Hamilton heavy metal stamping presses; Niles heavy machine tools; Special heavy machinery; Heavy iron castings; Weldments; Locomotives; Cranes and shovels.

YOUNG Announces the "HC"

HORIZONTAL CORE

ANOTHER VERSATILE VERTICAL AIR DISCHARGE UNIT FOR . . .

- ✓ JACKET WATER COOLING
- ✓ OIL COOLING
- ✓ GAS COOLING, CONDENSING
- ✓ STEAM CONDENSING



Basic "HC" Unit may be used in multiples for greater cooling capacity or combination of services.

IMPORTANT FACTS ABOUT THE "HC"

- LOW COST—small initial investment, economical maintenance.
- VERTICAL AIR DISCHARGE—eliminates cross wind effects.
- HIGHLY EFFICIENT—airfoil section fan.
- MULTIPLE INSTALLATIONS—provide greater capacity, combined services.
- NO VIBRATION—adjustable pitch fan mounted separately from unit.
- LARGE CAPACITY — water cooling, from 600,000 Btu/hr up; oil cooling, from 20,000 Btu/hr up.
- LOW HP REQUIREMENT—1 to 10 hp per fan.
- EASY INSTALLATION—simplified piping and frame construction.
- CORE GUARD SCREEN—protects cores from falling objects.

YOUNG

HEAT TRANSFER PRODUCTS

T. M. REG. U. S. PAT. OFF.

YOUNG RADIATOR CO.

General Offices: Dept. 409-E Racine, Wis.
Plants at Racine, Wis., and Mattoon, Ill.

OIL FIELD, HEAVY INDUSTRIAL, MUNICIPAL & CHEMICAL PROCESS COOLING EQUIPMENT

Engine jacket water coolers • Oil coolers • Steam and natural gas condensers • Natural gas coolers • Evaporative coolers and condensers • "VAD" Vertical air discharge cooling and condensing units

AUTOMOTIVE PRODUCTS

Gas, gasoline, Diesel engine cooling radiators • Heat exchangers • Intercoolers • Oil coolers • Supercharger intercoolers

HEATING, COOLING AND AIR CONDITIONING PRODUCTS

Convectors • Unit heaters • Heating coils • Cooling coils • Air conditioning units • Evaporative condensers

AERONAUTICAL PRODUCTS

Oil coolers • Supercharger intercoolers • Radiators • Heat exchangers • Valves • Regenerators

DISTRIBUTORS • The Hoopy Company, 310 E. 10th St., Tulsa 1, Oklahoma. A. R. Flournoy Co., 5043 Santa Fe Ave., Los Angeles 11, California. H. J. Young, 1364 Lake Shore Drive, Muskegon, Michigan. Others in Principal Cities.

● Here is another development by Young providing high efficiency cooling and condensing at low initial and operating costs. The Dual coil "HC" is designed for water and lube oil cooling. Manifolds are available for water cooling coils only. Four sizes, with 2, 4, 6 and 8 coil installations, provide exceptional versatility in heat transfer service. The 4 or 6 blade fan, serving each two coil unit, may be mounted directly on the fan motor shaft, or powered by a v-belt or gear speed reducer drive. Full details about the new "HC" Units, or other Young Heat Transfer Products, are available on request.

*UNIFORMITY

Under all conditions the proved performance of Tycol lubricants more than meets their recommended service.

Rigidly controlled and tested during manufacture . . . and refined from the highest grade crudes, Tycol oils and greases are known for their *UNIFORMITY within each classification — from the first drum to the last.

This unvarying high quality, plus the scope of the line, accounts for Tycol's wide acceptance by industry interested in maximum production . . . top efficiency . . . lowest operating cost.

Whatever your lubrication need, let a Tide Water Associated engineer help you select the one suited for your particular need. Call, write or wire your nearest Tide Water Associated office for full details.

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh • Philadelphia • Chicago
Detroit • Tulsa • Cleveland
San Francisco • Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE - NEW YORK 4, N.Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"
This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

Gardner-Denver Air Starter

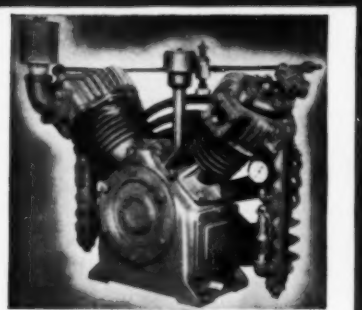
EQUIP YOUR DIESELS WITH THIS MODERN STARTER

POSITIVE STARTS . . . High torque developed by 5-cylinder radial air motor assures positive Diesel starts — even when high starting loads are involved.

SMOOTHER STARTS . . . Generous overlap of power impulses from 5-cylinder motor provides smooth flow of power for steady, even cranking.

SAFER STARTS . . . Exclusive Gardner-Denver feature engages pinion and ring gear when air valve is opened and just before power is applied to pinion. Engagement is positive and safe, and wear on gear teeth is minimized.

Gardner-Denver Air Starters — the modern way to start your diesel plant — assure positive, smooth, safe starts every time — eliminate costly battery maintenance and replacement. And it's easy to select the *right* starter to meet your requirements. For Gardner-Denver Air Starters are built in five sizes from 3 to 15 h.p., at 100 pounds air pressure — develop greater power at higher pressures. Several reduction gear ratios are available in each size.



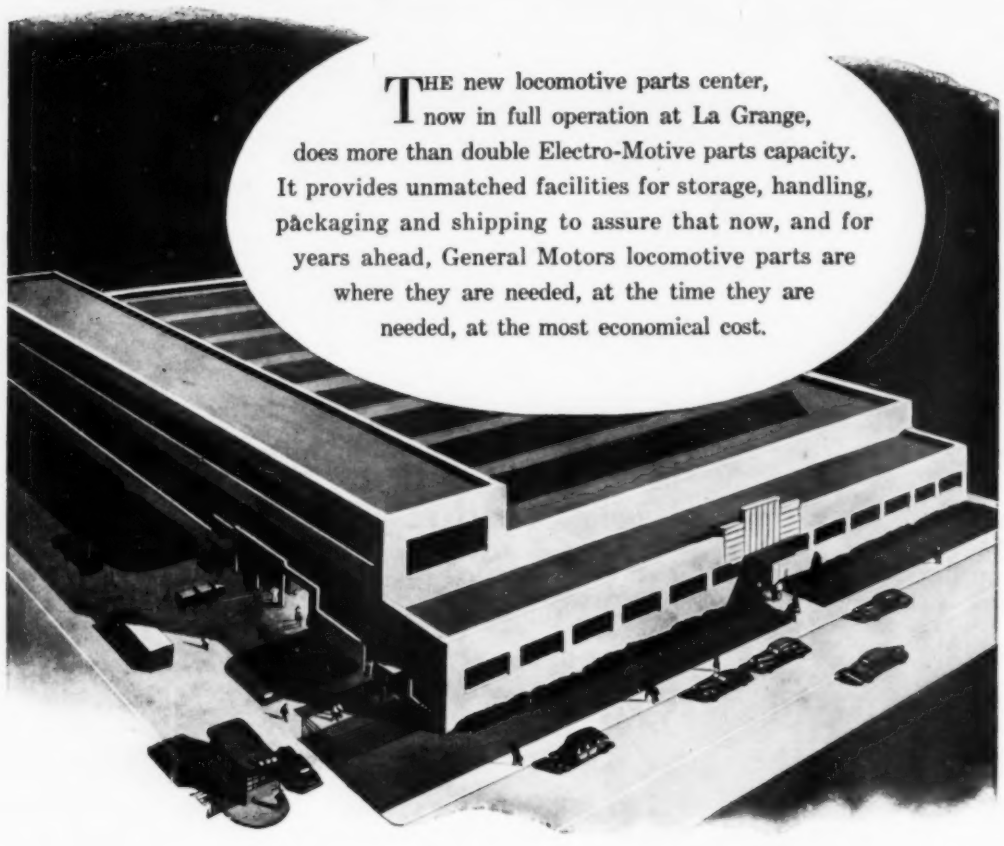
And for the dependable, low-cost air you need, insist on Gardner-Denver quality compressors. For example, this Gardner-Denver ADS Vertical Two-Stage Compressor is designed with such quality features as drop-forged alloy steel crankshaft, Timken adjustable roller main bearings, air-cushioned plate-type valves. Gardner-Denver starting compressors are available in capacities from 8.65 to 61.8 cubic feet displacement per minute.

For full information
write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER

Since 1859

Parts Facilities Doubled!



THE new locomotive parts center, now in full operation at La Grange, does more than double Electro-Motive parts capacity. It provides unmatched facilities for storage, handling, packaging and shipping to assure that now, and for years ahead, General Motors locomotive parts are where they are needed, at the time they are needed, at the most economical cost.

ELECTRO-MOTIVE

DIVISION OF GENERAL MOTORS • LA GRANGE, ILL.

Home of the Diesel Locomotive

GENERAL MOTORS LOCOMOTIVES

Marquette METAL PRODUCTS CO.

CLEVELAND 10, OHIO

SUBSIDIARY OF CURTISS-WRIGHT CORPORATION

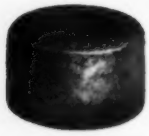
Also Manufacturers of: ROLLER BEARING TEXTILE SPINDLES

WINDSHIELD WIPERS FOR AIRCRAFT, TRUCKS AND BUSES • FUEL OIL PUMPS

FUEL OIL INJECTORS • PRECISION PARTS AND ASSEMBLIES

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.

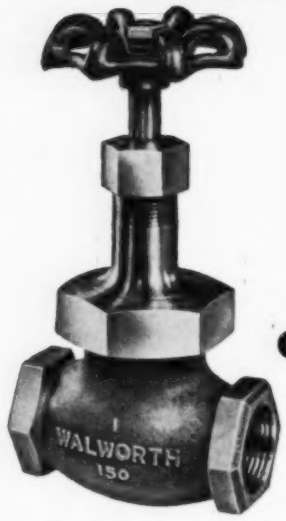


Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.

note these 7 Great Features

Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH



IMPROVED

No. 95

BRONZE

GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

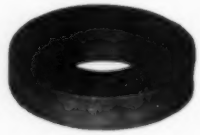
WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

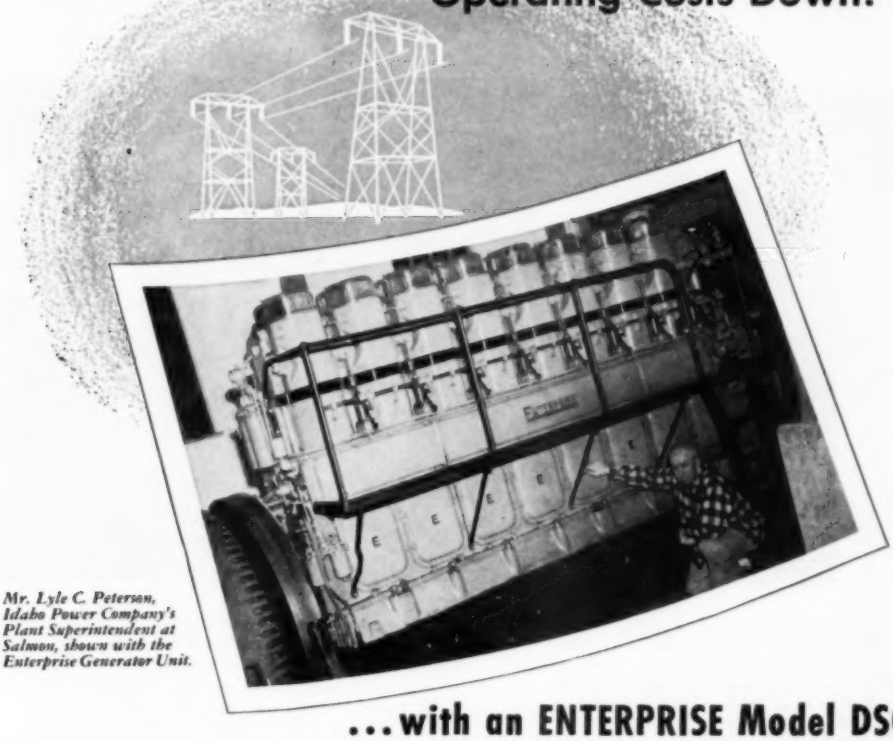


Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

At Salmon, Idaho...

Power Capacity Up *25%*
Operating Costs Down!



Mr. Lyle C. Peterson, Idaho Power Company's Plant Superintendent at Salmon, shown with the Enterprise Generator Unit.

...with an ENTERPRISE Model DSG-38

Power plants commonly find that when Enterprise Diesels go in, costs go down. That has been the experience at the Salmon plant of Idaho Power Company.

This plant, with 1255 HP in two hydro-electric units, has added 1070 HP in four diesel units at various times to meet rising power demands and offset erratic hydro power output caused seasonally by summer irrigation demands and winter ice jams.

Need for still more power led to the addition of the Enterprise DSG-38 in 1947. According to Mr. Peterson, the Salmon plant superintendent, this Enterprise unit *increased power capacity 25%*, and *reduced* the cost of operation by permitting use of 32 API gravity fuel instead of the 28 gravity fuel formerly required. The Enterprise has carried a large part of the plant load for long periods without difficulty. At other times it has operated efficiently with very small loads.

This same dependability, flexibility and economy is available in the complete line of Enterprise 4 cycle Diesel engines and generator sets. Write for full details.

ENTERPRISE *Diesels*

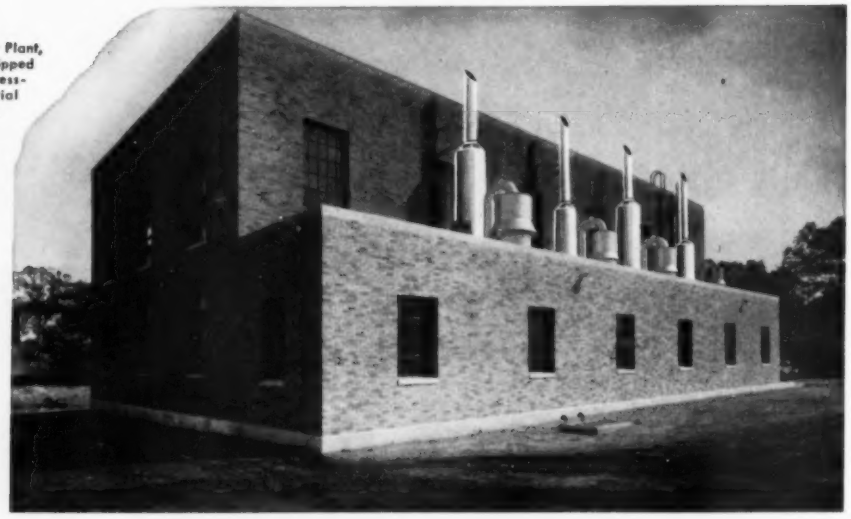
Choice of The Power Experts

ENTERPRISE ENGINE & FOUNDRY CO.
18TH & FLORIDA STS., SAN FRANCISCO 10, CALIF. OFFICES IN PRINCIPAL CITIES

Snub the Slug and Stop the Noise

from Engine Exhausts

Municipal Power Plant, Algona, Iowa, equipped with four Burgess-Manning Industrial Exhaust Snubbers.



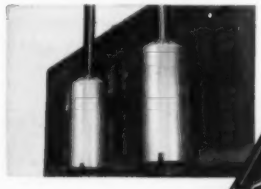
DIESEL and other internal combustion engines can be operated anywhere . . . without exhaust noise . . . when you equip them with Burgess-Manning Exhaust Snubbers. Widely used for such critical locations as office buildings, hospitals, community installations, ships, oil fields, and industrial applications where no exhaust noise disturbances can be tolerated or where danger of explosions or flying sparks must be eliminated.

Burgess-Manning Snubbers prevent noise by dissipating the "slugs" of gas from engine exhausts . . . with no interference to high engine performance. Special "Fog-jet" Snubbers snub the slugs to prevent exhaust noise, scrub out glowing sparks, spray a mist of cooling water vapor on the exhaust gases entering the Snubber . . . to cool and extinguish flame from the engine.

Burgess-Manning Snubbers are designed for Diesel, gas, dual fuel, and gasoline engines used in stationary, marine, locomotive, and portable service. A wide variety of types and sizes of Snubbers is available.

If you are considering the installation of Diesel or other type internal combustion engines, or if you have mechanical problems in exhaust systems, or noise complaints, let Burgess-Manning submit Snubber recommendations. Long experience guarantees complete satisfaction. Write for literature.

Power Plant at Marshalltown, Iowa, equipped with Burgess-Manning Exhaust Snubbers.



Burgess-Manning Spark Arrester-Snubber in use on a Shell Oil Company portable drilling rig.

The river boat "Jefferson" equipped with Burgess-Manning Marine Spark Arrester-Snubbers.

BURGESS-MANNING COMPANY

Libertyville, Illinois

DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY · IN TRANSPORTATION · ON THE SEA · IN THE AIR · UNDERGROUND

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FRONT COVER ILLUSTRATION:

Caterpillar Diesel D2 tractor skidding hardwood logs to the sawmill for the L. B. Proctor Lumber Company of Woodbine, Georgia.

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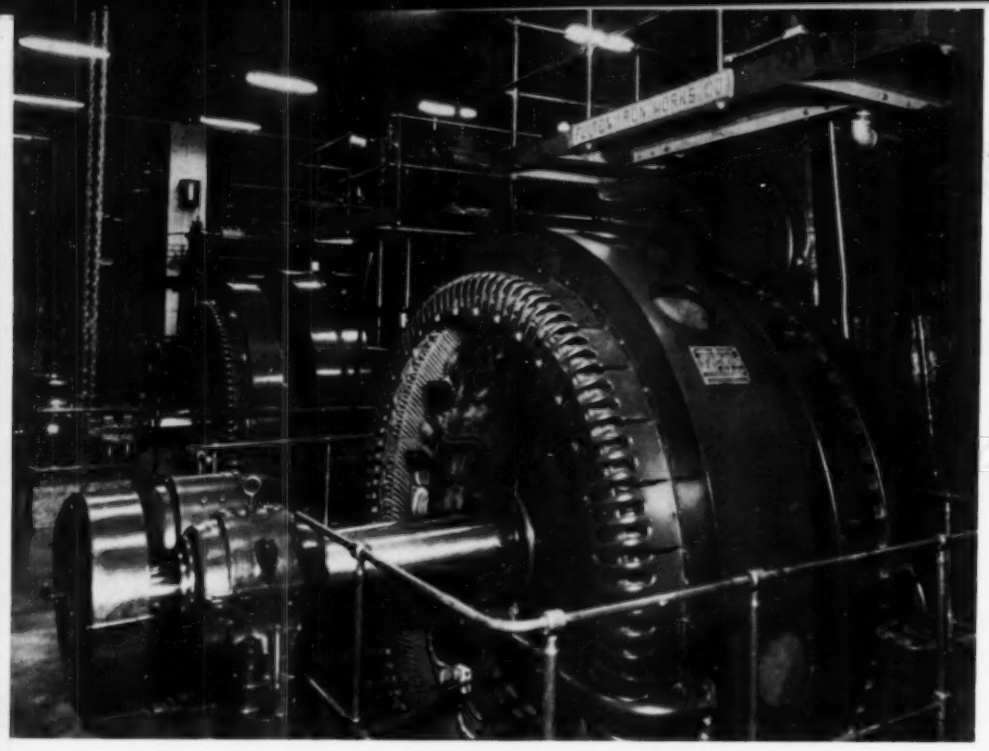
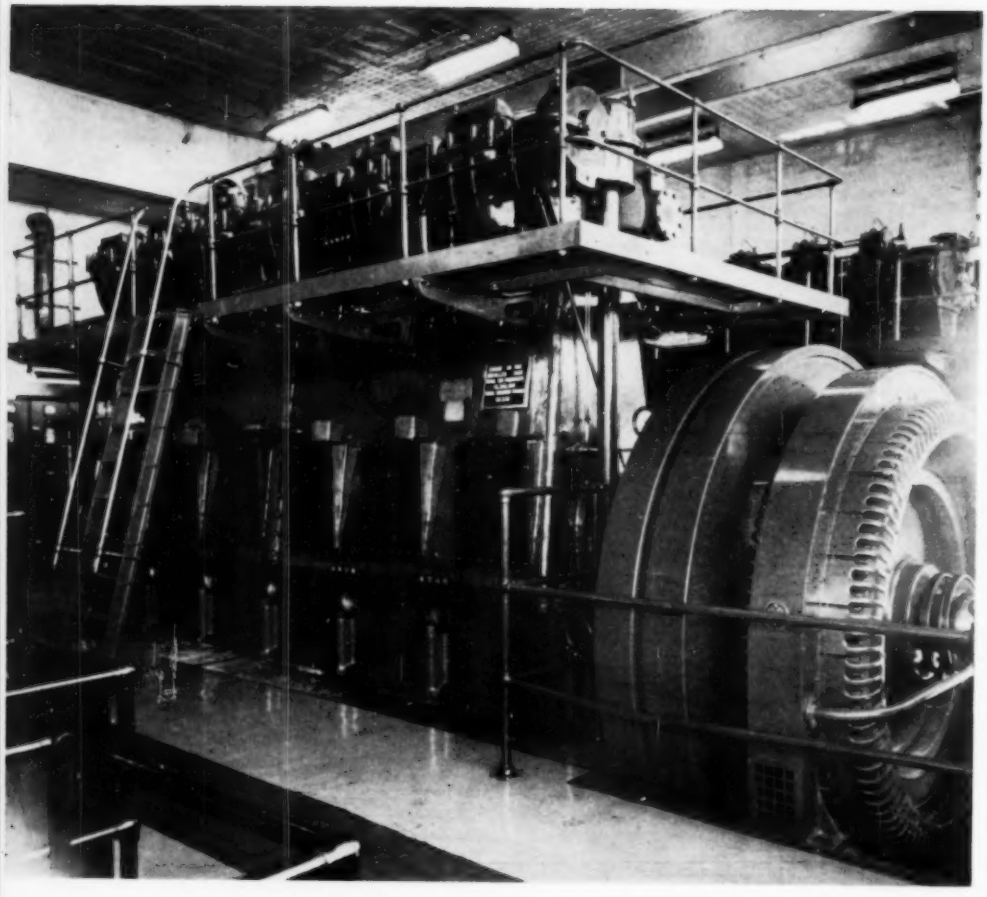


Four Fulton diesels that have operated more than 250,000 hours at the Hawarden, Iowa plant.



This twenty year old Fulton diesel has run 62,636 hours and generated 15,356,400 kw. hours.

HAWARDEN, IOWA

By WM. H. GOTTLIEB

IN a striking demonstration of diesel durability, three Fulton diesel engines have operated more than 250,000 engine-hours in the Hawarden, Iowa, municipal power plant. A second notable fact is that the current performance of these veteran units, in service for as much as 23 years, is the most efficient in their long history. Meanwhile, a Fulton diesel, installed in 1946 and converted to dual-fuel operation in 1948, is showing the economies possible through use of cheap natural gas in modern diesels.

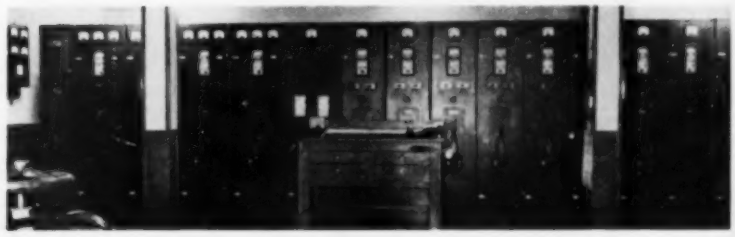
The first two diesels, put to work in the Hawarden plant in March 1925 to replace an obsolete steam plant, were a 400 hp., 4 cylinder and a 300 hp., 3 cylinder, 16½ x 24½ in. Fulton operating at 200 rpm. The third unit, installed in 1928, is a 6 cylinder, 17½ x 24½ in. Fulton rated 750 hp. at 225 rpm. All three engines are 4 cycle, air-injection diesels. When this writer visited the plant in September, 1948, the 400 hp. engine had run 96,498 hours and generated 12,803,775 kw. hr. The 300 hp. unit had run 96,473 hours and produced 9,320,500 kw. hr. The 750 hp. diesel had run 62,636 hours and generated 15,356,400 kw. hr.

A check of operating data for the latest 12 month period then available, Sept. 1947 through Aug. 1948, showed that these three air-injection engines had produced 1,515,425 kw. hr. and consumed 136,820 gal. of fuel for an average of 11.07 kw. hr. per gal. of fuel. This efficiency is better than the new-engine performance of these diesels and is unsurpassed by any annual average of these units in more than two decades.

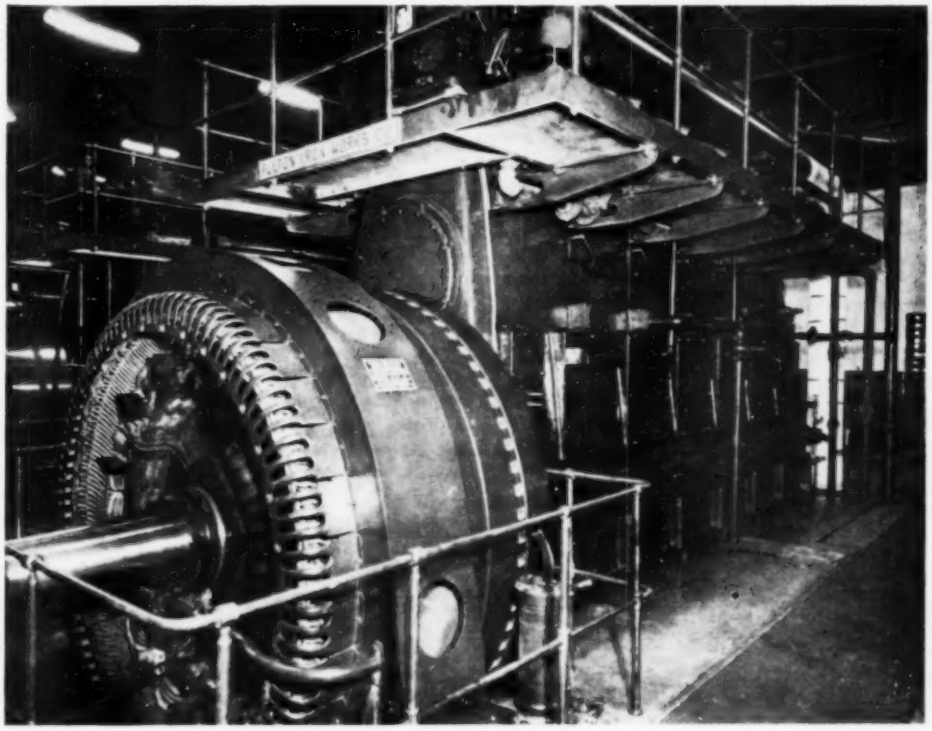
These engines supplied all light and power for the 3,000-population community for more than 20 years while power production grew from 529,750 kw. hr. in 1926, the first full year of diesel operation, to 2,263,525 kw. hr. in 1945. Through the war years, peak loads were so close to plant capacity that all three units were required to handle the peaks. Although the normal maintenance schedule calls for an overhaul every 4,000 engine

Lubricating oil is cleaned in these three Honan-Crane purifiers.

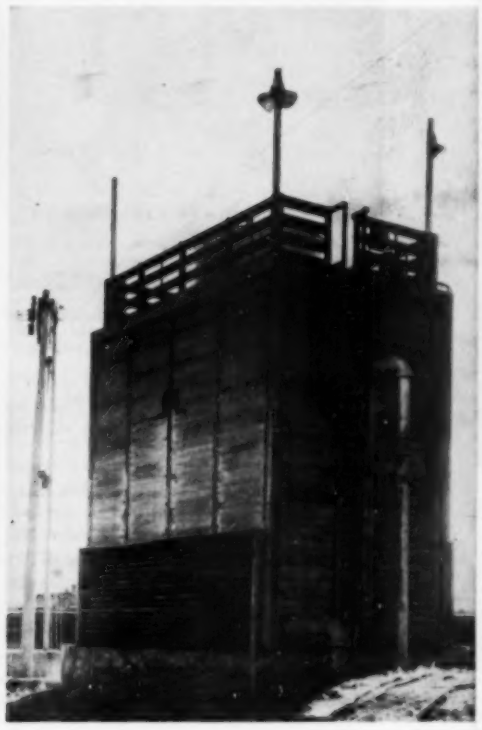
This switchboard was built by Schneider Electric Works and is equipped with G-E switches.



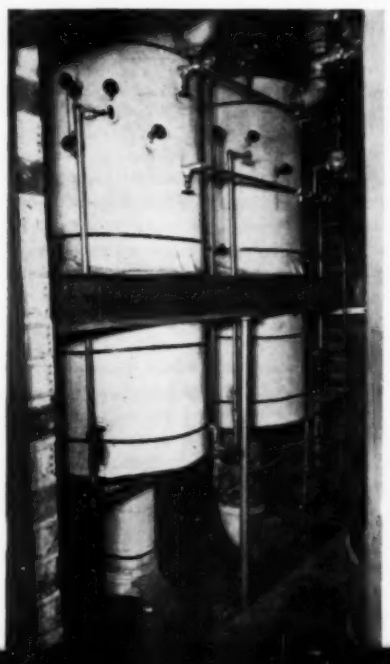
Latest Fulton 960 hp. Diesel converted to dual-fuel cut fuel costs more than 40 percent.



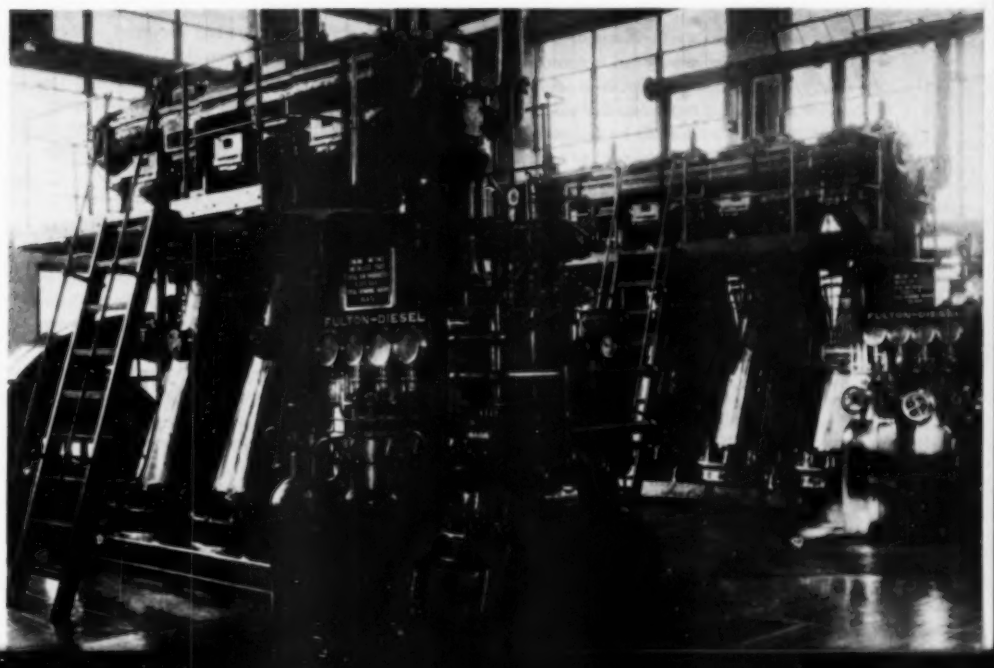
Engine cooling water is pumped through coils in this Marley induced draft cooling tower.

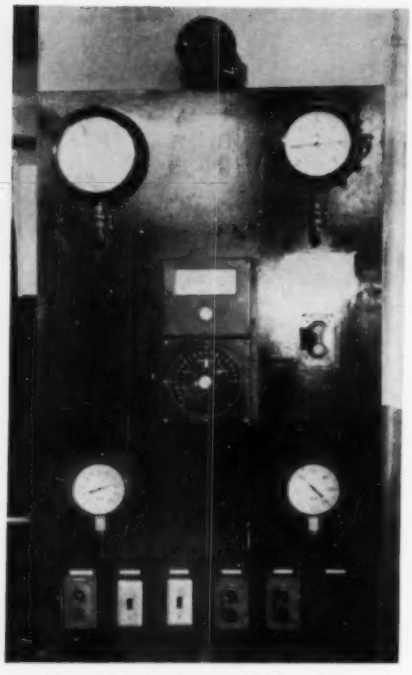


Maxim combination silencer-waste heat boilers which provide steam to heat the plant.



Two Fulton diesels, installed in 1925, produce more power per gallon of fuel than they did when they were new.





An alarm panel serving all the diesels includes a multi-point Alnor exhaust pyrometer.

hours, the 750 hp. diesel could not be spared long enough to pull pistons and ran nearly 20,000 hours between overhauls. Yet there were no engine failures.

Badly needed surplus capacity was supplied in 1946 with the installation of a 6 cylinder, 17½ x 24½ in. Fulton diesel rated 960 hp. at 277 rpm. This unit is a 4 cycle, mechanical-injection diesel. It will be observed that the new engine, while higher in speed than its predecessors, is still a slow-speed engine by modern standards. Through the years, Fulton Iron Works Co. has been conservative in its approach to higher rotative speeds and feels that its conservatism has paid dividends in the long life and continued efficiency of engines. Certainly the experience at Hawarden is an argument for this position.

Operating on fuel oil, the new engine returned as much as 13.2 kw. hr. per gal. of fuel consumed with a 62.4 per cent load. This meant important savings for the plant, but with fuel oil prices high, even greater opportunities for economy were available if natural gas could be used as fuel. The new engine was converted to dual-fuel operation in 1948 at a cost of $6,000 and will more than pay off that cost in fuel savings in the first year. When this writer investigated the records in September, the engine had operated two months on natural gas with oil as a pilot fuel. Production averaged 38.6 kw. hr. per gal. of oil and 90.4 kw. hr. per 1,000 cu. ft. of gas. This meant an oil cost of $.00324 per kw hr. and a gas cost of $.00255 per kw. hr. for a total fuel cost of $.00579. Compared with an average fuel cost of $.01 a kw. hr. when oil alone was used, the dual-fuel gives a saving of $.00421 per kw. hr. Superintendent of Utilities W. C. Rush expects even better economy in the future when he gets the engine adjusted to the most sparing use of pilot fuel.

The gas, with a heating value of 1,000,000 Btu. per 1,000 cu. ft., reaches the plant at 6 to 7 pound pressure and is reduced by a regulator to 39 ounces before it is drawn into the cylinders on the down stroke of the pistons. The other engines are run on a blend of South Texas crude of 24-26 gravity and gas oil of 32-36 gravity in the proportion of one car of crude to two cars of gas oil. Mr. Rush feels that the gas oil alone works best as pilot fuel for the dual-fuel unit.

Fuel oil is unloaded by a motor-driven Viking rotary pump into two 10,000 gal. storage tanks and flows by gravity to a 300 gal. supply tank in the plant basement. Engine-driven transfer pumps on the oldest engines send the oil to elevated day tanks in the engine room. The 750 hp. diesel is supplied from an overhead day tank filled every hour with a motor-driven pump. The new engine has its day tank in the basement where it is filled automatically by a motor-driven pump. The oil is then drawn by an engine-driven pump through an Empire meter and a Cuno filter to the injection system. Injection for the new engine is regulated by a Pickering governor.

Hawarden uses lubricants specially suited to the varying equipment and functions in the plant. Thus, Socony Vacuum's DTE No. 3 is used in the cylinders, Vacme No. 3 in the crankcases of all but the 750 hp. unit which uses Nonpareil Heavy Duty lube. No oil is discarded. The lube is cleaned continuously in three Honan-Crane purifiers with Cranite elements; one purifier serves the two oldest engines with one each for the larger diesels. The purifiers are in service 24 hours a day, drawing oil from the sump tanks and returning clean oil to the tanks. They are shut down only when it is necessary to change the filtration element. The same pumps that circulate oil to the purifiers are used to prime the oil lines before an engine is started.

Mr. Rush reports that lubrication results are highly satisfactory. When the 750 hp. unit was overhauled after 19,579 hours of operation, the Doubleseal rings were free and in perfect condition. There was virtually no bearing wear. Maximum wear on the cylinder liners in 60,636 hours was .052 in. Detailed records on every engine part and accessory part in the plant take the guess-work out of maintenance. Hawarden engineers know how their equipment is performing.

Three motor-driven centrifugal pumps send jacket water from a hot well through coils in a Marley induced-draft cooling tower, through the engine jackets and back to the well. City water used for makeup is treated in a Warlow Zeolite softener and also with Feedwaters chemicals to inhibit rust and corrosion. Untreated city water is pumped over the tower by another trio of motor-driven centrifugals. In hot water, all pumps and full tower capacity are required to cool the engines. The jacket water system also has an emergency connection to the city water supply.

Hawarden has an interesting system for utilizing exhaust heat to heat the building in cold weather. Exhaust gases from each engine pass through an individual combination Maxim silencer and waste heat boiler. These water-jacketed silencers provide steam which circulates through piping and radiators throughout the large building. Condensate returns to a Maxim accumulator tank in the basement which supplies water to the silencer jackets. Makeup water is provided by a pair of motor-driven Jennings centrifugal feed water pumps which operate all the time. Admission of water to the accumulator tank is controlled automatically by a Fisher admission valve actuated by tank pressure. As steam pressure rises, the quantity of water admitted is reduced.

Air filters for all the engines are enclosed in a filtration room above the shop. Burgess filters are used for the oldest units, American for the others. The original engines require 900 lb. starting air and have separate air bottles. Two tanks are kept at 250 lb. for the 750 and 960 hp. units. Air for starting is commonly supplied by a Quincy motor-driven compressor although the engine compressors can be used.

Virtually all electrical equipment in the plant is General Electric. All the diesels drive GE 3 phase, 60 cycle, 2400 volt generators. The 16 panel enclosed unit switchboard, built by Schneider Electric Works, includes GE diactor regulators, synchroscope, polyphase watt-hour meters, recording voltmeter and wattmeter, oil circuit breakers and other equipment.

The Hawarden municipal power plant has performed its major task of providing a dependable power supply at rates substantially below those prevailing in similar communities, but that is not all the plant has contributed to its communal owners. For seven years, during the depression, the city levied no taxes whatsoever, paying all expenses of government and municipal services out of plant funds. In 1926, a flood badly damaged the town and the new power plant provided the money for essential repairs. Power plant revenues went for the purchase of an airport site, a fire engine, an athletic park, tennis courts, skating rinks, street paving, a new street lighting system, a city auditorium, and other public improvements. Direct cash contributions have totaled more than $125,000. The plant provides free lighting for streets and civic buildings.

Despite these substantial contributions, plant profits have been sufficient to amortize purchased equipment in advance of a conservative depreciation schedule. Though the plant represents an investment of more than $250,000, it was debt-free until revenue bonds were issued in 1945 to finance the purchase of the new engine. On Sept. 1, 1948, there was $88,000 outstanding and $19,500 in the cash and bond retirement funds, leaving a net debt position of $68,500. It is confidently expected that increasing revenues and the economies of dual-fuel operation will insure substantial profits in the years ahead, wipe out the debt, and permit further contributions to the public welfare.

THREE NEW GENERAL MOTORS LOCOMOTIVES

THREE new mainline diesel locomotives which will enable North American railroads to either importantly increase the tonnage per train or speed up schedules of present length trains are announced by C. R. Osborn, Vice President of General Motors and General Manager of Electro-Motive Division of LaGrange, Illinois.

The new F series units and the new E series are so designed that the old F units now owned by a railroad can be operated with the new F7 and FP7A units and the old E units can be operated with the new E8 units. The new motors and generators will have considerably longer life between major overhauls than the present electrical transmission equipment on diesel locomotives.

A new injector perfected for General Motors locomotive diesel engines made by Electro-Motive broadens the range of fuels that may be successfully used. Heretofore locomotive diesels required fuel of at least 55 cetane rating. The new General Motors injector makes it posisble to use cheaper fuels of as low as 40 cetane rating. An important by-product of the new injector is the reduction of peak shock cylinder loads for all qualities of permissible fuel, with resultant longer engine life.

The F7 locomotive retains the same weight, length and height dimensions as the F3, plus the wide range characteristics made possible by the eight optional gear ratios and variations in number of units that can be coupled or uncoupled to fit the locomotive capacity to the size of the train. However the range is broadened by the increase in tractive effort of the F7.

Due to the new capabilities of Electro-Motive traction motors and generators the maximum continuous tractive effort of the F7 per unit goes up to 52,400 pounds, as compared with 42,500 in the F3. Horsepower rating of the diesel engine remains at 1500 for propulsion alone. Top speed remains 102 miles per hour as in the F3, but due to the greater "lugging" abiltiy, the F7 will be able to haul heavier tonnages.

The new F7 will haul 25 per cent more tonnage up a 1 per cent grade at continuous rating and 30 per cent more tonnage at short time ratings for two hours. Since there are only a few grades in the United States which require more than two hours to climb with the heaviest train permissible with present draw bars the effect of this is that most railroads will be able to increase tonnage 30 per cent wtih the new units.

The capacity of the electric retarding, or "dynamic," brakes of the F7 has been increased so that 25 per cent more tonnage can be safely controlled. The capacity of the brakes has been increased from 540 to 600 amperes in the F7.

This increase in dynamic braking capacity is important in that it will enable the railroads to further decrease the use of air brakes with still further saving on brake shoes, wheels and air brake equipment.

The elimination of organic material in the insulation through the use of silicon, glass and mica, which are practically unaffected by heat, cold or moisture, would permit increase of traction motor temperature, but with the improved insulation technique developed by Electro-Motive and the improved motor cooling the higher ratings are accomplished with an actual decrease in traction motor temperatures. Consequently the life of the new motors will be greatly increased over the old type with silk and mica insulation.

Auomatic transition is standard equipment in the F7. This marks the first time that this feature—which has been of great usefulness in General Motors high speed passenger locomotives for many years—has been standard on the heavy duty locomotives. It was available as an "extra" heretofore. Without automatic transition, the changing of the connections between traction motors to give them variations in performance to meet varying requirements for starting, accelerating and maintaining speed with heavy loads has been a manual operation performed with a control lever by the engineer on the F series locomotives.

The new F7 has startling excess train heating capacity. The A units have 2500 pound steam generators and the B units can be equipped with either 2500 pound or 4000 pound generators. Thus the total in a two unit F7 locomotive may be 6500 pounds, or an increase of 1900 pounds over the F3 maximum. In a four unit F7 the total capacity can be 14,500 pounds as against 10,600 pounds in a four unit F3.

The new FP7A incorporates all the improvements of the F7 and is provided with an additoin of four feet in length. This permits the installation of an additional 950 gallons of train heating water. Total water capacity is 1750 gallons. The F3A units had a maximum of 800 gallons water capacity. This special locomotive unit was designed to meet the needs of railroads with long passenger runs in which it is desirable to lengthen the distance between water stops. The FP7A can be combined at will with F7 or F3 units.

Improvements in the E8 advance the high speed diesel passenger locomotive to a new level. These improvements include: Greater continuous tractive effort, increased horsepower, increased train heating, dynamic brakes, AC drive for all auxiliaries eliminating all V belts, controlled engine room temperature, pressurized, completely filtered engine room air system, and increased train heating water capacity.

The E8 retains the major, proven advantages of the General Motors high speed passenger locomotives of the past, notably the reliability on the road and speed with stability and safety that come from dual power plants, the six wheel outside swing hanger truck design, and locomotive length, height, and width with balanced distribution of weight.

The same improvements in traction motors described heretofore for the F7 are utilized in the E8 which results in a traction motor rating increase of as much as 25 per cent with no increase in temperature, and with substantial increase in motor life. Horsepower rating of the E8 is raised to 2250 per unit as compared with the 2000 horsepower rating of the E7. Maximum continuous tractive effort of the E8 per unit is 27,000 pounds, compared with 21,400 in the E7.

The alternating current auxiliary drive feature which was one of the great features of the F3 in 1946 is made standard equipment in the E8, made possible by the new AC-DC generator specially designed for this locomotive. All V-belt drives are eliminated in the E8 and the isolated AC drive for accessories permits a simplified engine room equipment arrangement that facilitates faster maintenance and repairs with lower costs.

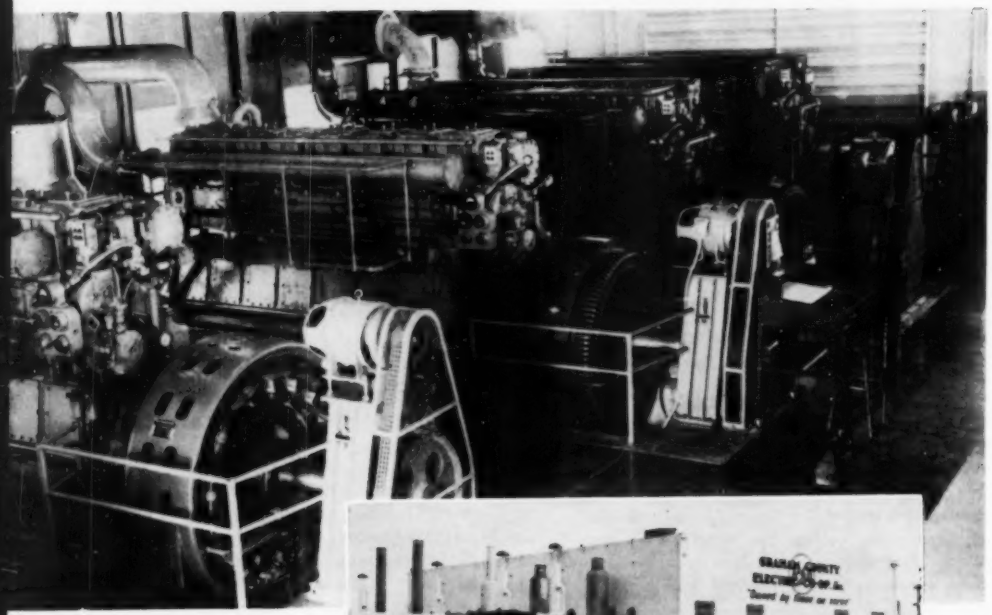
As in the F7 outstanding improvement in train heating equipment has been made in the E8. For years 2250 pound steam generators were regarded as suitable for a 2000 horsepower passenger unit. During the past two years this has been increased generally to 3000 pounds per unit. By rearrangement of the engine room equipment each E8 unit now can have either one 4000 pound steam generator or two 2500 pound steam generators. The result is a train heating plant such as never before has been provided.

REA TO SPEND TWENTY MILLIONS FOR DIESELS

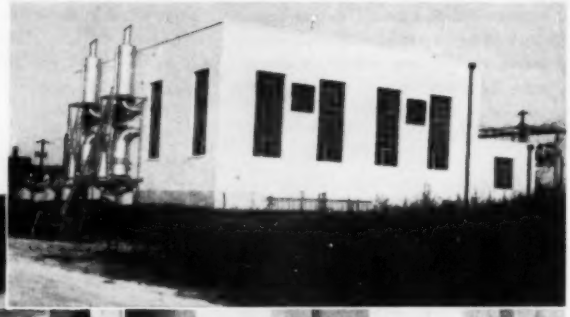
By FRANKLIN P. WOOD

THE last few years have witnessed a remarkable growth in REA-financed power plants. It is to be noted that now, more than ever, emphasis is being placed on using the term "internal combustion equipment" rather than "diesel engines." This has come about as far as REA is concerned because of the great increase in cost of fuel oil for such engines. Some REA cooperatives are now paying three times what fuel oil cost several years ago. This has forced REA borrowers, in common with other utility operators throughout the country, to seek cheaper methods of generation.

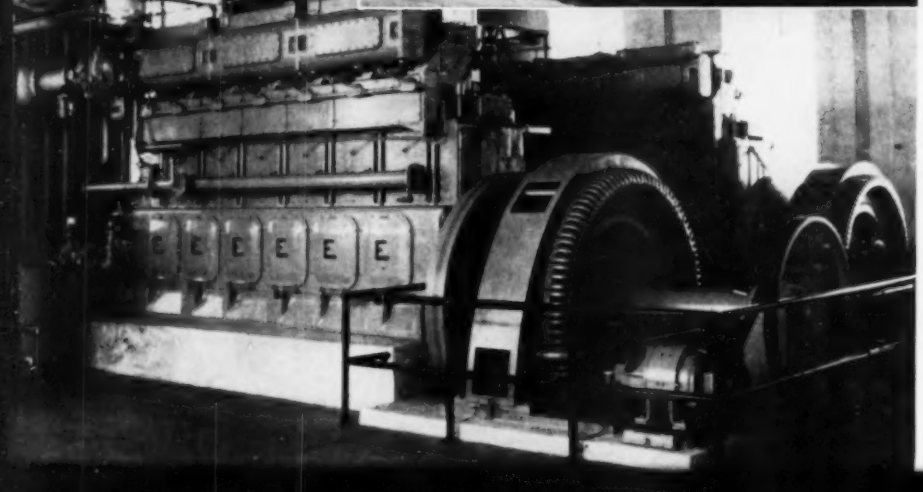
The trend in REA-financed installations of internal combustion engines has been toward the use of Natural Gas, when it can be secured at a reasonable rate, in dual-fuel engines which utilize the diesel cycle. Present practice in general requires the use of a small percentage of fuel oil injected into the engine with the natural gas in order



(Above) The Graham County plant showing four of the five Cooper-Bessemer engines. (Right) The Graham County Electric Cooperative of Pima, Arizona.



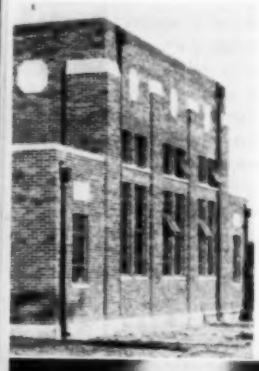
(Right) Rear view of the Moore Haven, Florida plant. (Below) Two 840 kw. Enterprise turbo charged diesels.

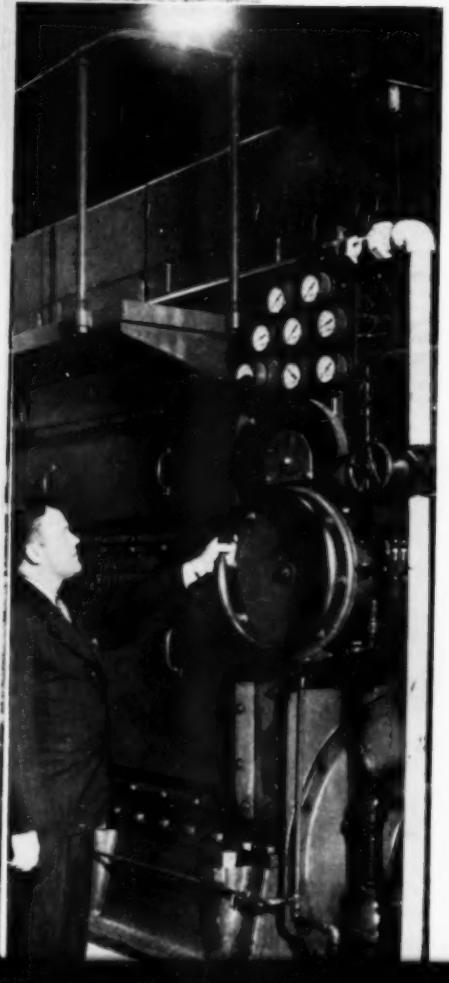


properly to maintain combustion. Quite a number of dual-fuel plants have been installed with uniformly satisfactory results. Where dual-fuel engines can be used the practice is to use them.

It also became the practice a few years ago to specify supercharging on most diesel engines and this applies likewise to the dual-fuel type. This practice has resulted in considerable gain in the efficiency of such engines which tends to some extent to offset the increasing cost of fuel oil.

Realizing however that not only the cost of fuel would probably tend to increase but that the supply would tend to decrease (and this undoubtedly applies to gas also) the Power Division of REA started a few months ago to study the question of using producer gas from coal or lignite. This probably means also that some small amount of fuel oil using the same diesel cycle will be required.





(Left) Front entrance of the Central Kansas Electric Cooperative plant at Great Bend, Kansas. (Below) One of two 1000 kw. dual-fuel Worthington diesel engines.

Of course the difficulties chiefly concerned with proper cleaning of the producer gas were well known and recognized; nevertheless considerable investigation is being carried on in cooperation with the Diesel Engine Manufacturers Association, the manufacturers of gas producers and others whose interests will be affected.

Investigation is also proceeding on the theory that if gas of satisfactory quality can be produced from coal it will open up the opportunity to use the abundant supply of coal and lignite in the United States and will greatly increase the usefulness of the internal combustion engine industry. Since funds are not available in REA for anything more than initial inquiries in this field, our effort can do no more than stimulate a real research plan which should be vigorously followed up by all interested parties, including particularly the coal industry itself.

By the same token, REA is not neglecting the possible development of hydro power where available. Many such projects are becoming feasible with low cost money available to REA borrowers.

Of course as the REA-financed power systems grow in size and importance the use of steam plants is increasing. This is largely because coal will be economically available for a much longer period of time, and the size makes steam more efficient than internal combustion units. One 20,000 kw. turbine is being installed by one of the borrowers and several 11,500 up to 15,000 kw. units are installed or are being installed.

As of January 1, 1949 REA has financed plants having a total capacity of approximately 250,000 kw. already installed. Of this total about 180,000 kw. are internal combustion units, including a number of mobile and skid units used primarily for emergency purposes. The balance is divided roughly into 20,000 kw. hydro and 50,000 kw. steam. These figures do not include the many steam plants now under construction and two hydro plants soon to go into service. It is to be noted that the trend is toward more steam plants. The reasons for this are (1) because of larger plants being required the economy of production is in favor of steam and (2) the great increase in price of fuel oil and its apparently limited future.

Within the last year the organizational set-up of REA was changed by the creation of a Power Division of which Mr. J. B. McCurley is chief. This division is charged with the responsibility of helping borrowers not only to supervise the planning and construction of REA-financed plants but also to manage, operate and maintain them.

More emphasis is being placed on operation and maintenance which should result in considerable saving in cost of production and assurance of service. Emphasis is laid on regular scheduled maintenance, particularly of internal combustion plants. The borrowers have carefully worked out schedules for each plant so that maintenance is kept up. Maintenance does not, of course, mean waiting until a break-down occurs, and then making repairs. A great deal of care is taken to anticipate break-downs thereby preventing them. This is the proper way not only to secure lower costs but to give better service which is of paramount importance to all cooperative members.

Over 95 per cent of the money lent by REA for generation facilities has been to cooperatives organized for the purpose. A small amount has been lent to municipalities having power plants and to some commercial suppliers. All of the money is on loan, to be repaid over a 35-year period at two per cent interest. Practically all borrowers are meeting debt-service payments in accordance with schedules, and many are ahead of schedule. Record in this respect is better than many privately-owned and operated utilities.

In spite of what some may read into the above statements concerning the gloomy prospect for oil to be used for generation, it is not our intention to argue that there is an immediate danger of oil becoming too scarce and too expensive to entirely eliminate the use of internal combustion engines. Perhaps there is a greater supply underground than we know. However with oil at 10 or 12 cents per gallon delivered at the plants and supplies limited, it behooved REA to look into the future and try to prepare for any eventuality.

There is little to be said about new features in REA-financed plants. Efforts are being made to keep the cost of the power plant buildings down to a minimum consistent with useful service.

Very few engines of less than 1000 kw. capacity are being considered for REA-financed power plant installations. Several units of 2500 kw. and over will probably be financed. In all of these the dual-fuel features are given especial study and consideration.

One of the greatest difficulties with which the cooperatives have to deal is that pertaining to cooling water. The troubles are gradually being overcome by more detailed and careful handling of water treatment. In many instances radiator cooling is resorted to, generally with success. However, here too it is found necessary to apply water treatment to the cooling water because of damage to coils, if the water is not properly treated.

The accompanying photographs illustrate some of the more recent installations. Loans have been made to build or add to approximately 22 internal combustion installations during fiscal year 1949. These loans amount to about $20,000,000. Loans for steam, hydro and transmission systems amount to about $30,000,000 more, bringing the total of power plant and transmission funds up to about $51,000,000 for the first three quarters of fiscal 1949 alone and may reach as high as $90,000,000 for the fiscal year.

The benefit which internal combustion engines have brought to the farms of America cannot be overestimated. Without them many farms now enjoying the great benefit of central station power would still be without any electric service. They pay out not only from the financial standpoint but from the standpoint of developing rural America to the point where living on the farm approaches parity with living in the city.

Factors in the Selection of Engine-Driven A-C Generators

By S. P. BORDEAU*

IN THE installation of electric generating sets it is essential (1) that the generators selected be adequate for the required capacity and characteristics of the power plant, (2) that the generators provide the necessary quality of voltage regulation, and (3) that the apparatus have proper features to give full dependability for the continuity of service needed.

Careful analysis and interpretation of load requirements, and selection of generators to meet the above essentials involves consideration of several factors. The following questions are presented as a brief guide to items requiring regular or special attention for the usual engine-driven plant. Where further elaborated information on any of these items is required it can be obtained from the generator manufacturer.

Item 1—What Type of Service Is To Be Used?

The various standard types of generator service and the general range of their use are shown in the chart below. Where the generators are applied to an existing load this will usually fix the type of service to be used.

Sixty cycles is standard in the U. S. Foreign countries use either 60 cycle or 50 cycle power. Single-phase service is used only for smaller plants, such as for farm plants and other establishments using motors 10 hp. and smaller. For industrial or large service using three-phase motors, three-phase is standard. For high-voltage service, generation at 2400 volts is most common.

Item 2—Have All Factors Been Considered in Determining the Peak Capacity Required?

Load analysis should be made by checking and totalling the various individual loads to determine the peak capacity that will be necessary to meet daily or seasonal maximums. Allowance should be made for contemplated additions to plant load.

Particular attention must be given to the capacity of the generators from the standpoint of successfully providing the starting requirements of large motors. Oil-field motor pumping loads and refrigeration loads are an example of this. In some instances it may be possible to reduce peak loads by re-arrangement of the operating periods of large motors.

Item 3—Are the Generators for Temporary (Portable) Installations?

For this type of installation the "Packaged" Generator is advantageous. The generator control is mounted on and connected to the generators at the factory, and a panel-type switchboard with its attendant wiring is not necessary. When a move is made there is maximum salvage value since a minimum amount of wiring needs to be dismantled.

Item 4—What Type Generator Is Most Suitable?

The type of generator construction will generally be determined by the size and speed of the engine. Chart on the next pages shows the range of application of various engine-driven generators. For belt drive, consideration must be given to pulley ratio and overhang. Modifications of generator construction are available to meet special requirements. "Packaged" generators are widely used for capacities below 187 kva. at low voltage.

Item 5—How Many Generator Sets Should Be Used?

Use of multiple generators is subject to several factors including the relation of average loads to peak loads, the diversity desired in operation of the generator units and the need for emergency peak capacity or standby service. Space provision for likely additional generator sets should be considered.

Item 6—What Generator Voltage Regulation Is Necessary?

High quality voltage regulation is essential for most generating installations, particularly for lighting and other loads sensitive to voltage fluctuations. Starting and stopping of large motors, periodic large variations in large motor loads, and on-and-off loads of other types such as welders and furnaces must be taken into consideration in determining provisions necessary to keep voltage variations within the required limits.

Item 7—Should the Generator Power Factor Be Other Than Standard?

Standard generators are rated in kva. at 0.8 lagging power factor, representing an average condition under which the generator will be operated. Special situations involving very low power factor loads may make desirable the use of generators of lower than 0.8 power factor rating.

Item 8—Should Other Than Standard Temperature Rise Be Specified?

When a standard generator is operated at rated capacity, voltage and speed, the temperature rise of the stator, measured by thermometer, will not exceed 50° C., and the rotor, measured by resistance, will not exceed 60° C. These are based on 40° C. ambient temperature, normal ventilation and altitude of 3300 feet or less.

Where the prime mover has short-time overload capacity, the generator should correspond.

Item 9—Will the Generators Operate At High Altitude?

The operation of generators is affected at high altitude due to reduced ventilation afforded by the thinner air. Special provision should be made for generators to be operated at higher than 3300 ft. altitude.

Item 10—Should Higher Than Standard Efficiencies Be Specified?

Efficiencies higher than normal can be supplied, within limits, for larger generators. These higher efficiencies add to the first cost of the generator but may be warranted where highest power conversion economy is essential.

*Electrical Engineer, Electric Machinery Mfg. Co., Minneapolis, Minn.

Fig. 1—"PACKAGED" Regulectric TYPE GENERATOR. RATINGS: 3.75 kva to 18.7 kva; SPEEDS: 1200 rpm and 1800 rpm having a built-in circuit, with non-moving components, which automatically keeps the voltage at rated value despite changes in load.

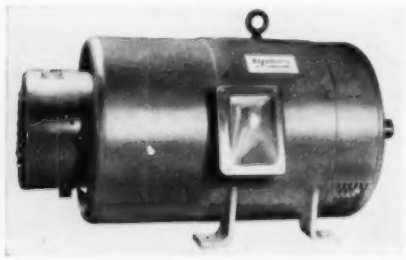


Fig. 2—"PACKAGED" Regulectric TYPE GENERATOR WITH METERS. RATINGS: 12.5 to 37.5 kva; SPEEDS: 900 rpm to 1800 rpm. In addition to built-in automatic voltage regulating circuit, this generator has ammeter, voltmeter and voltage pre-set switch.

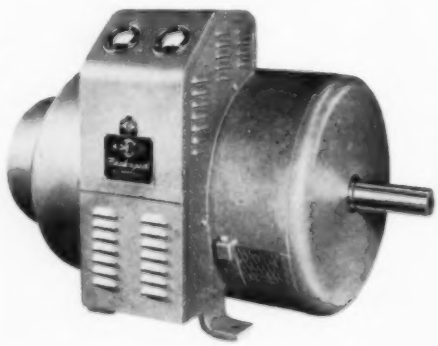
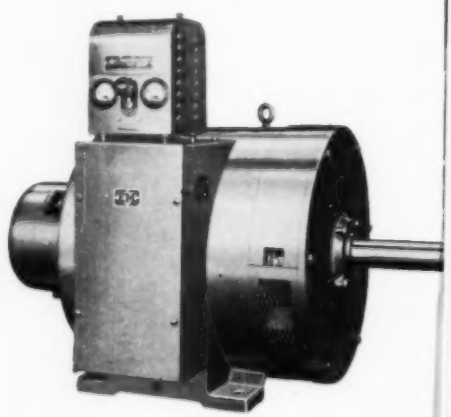


Fig. 3—"PACKAGED" Synchrostat TYPE GENERATOR. RATINGS: 37.5 kva to 187 kva; SPEEDS: 1800 rpm and lower. This generator combines a vibrating reed type voltage regulator, ammeter, voltmeter and voltage pre-set switch. Generator is connected to load thru a line switch.



TYPES OF GENERATOR SERVICE...

	GENERATOR VOLTAGE	STANDARD SIZE RANGE *	PROVIDES ELECTRICAL SERVICES SHOWN BELOW	NUMBER OF LINE-WIRES	FOR ELECTRICAL LOADS SHOWN BELOW
LOW VOLTAGE	120/240 VOLTS Single-Phase	62½ Kva and Below	SINGLE-PHASE 120 Volts, 2 Line-Wire or 240 Volts, 2 Line-Wire or 120/240 Volts, 3 Line-Wire (120 Volts between Line-Wires and Neutral; 240 Volts between Line-Wires)	2 Line-Wires or 2 Line-Wires and one Neutral Wire	LIGHTS, APPLIANCES, HEATERS and SINGLE-PHASE MOTORS marked for 110, 115 or 120 volts, or for 220, 230 or 240 volts
	120/208 VOLTS Single and Three-Phase	875 Kva and Below	SINGLE-PHASE 120 Volts between Neutral and any Line-Wire and THREE-PHASE 208 Volts between 3 Line-Wires	3 Line-Wires and one Neutral Wire	LIGHTS, APPLIANCES, HEATERS and SINGLE-PHASE MOTORS marked for 110, 115 or 120 volts and THREE-PHASE MOTORS marked for 208 or 220 volts
	240 or 480 VOLTS Three-Phase	875 Kva and Below at 240 Volts 1875 Kva and Below at 480 Volts	THREE-PHASE ** 240 or 480 volts between 3 Line-Wires SINGLE-PHASE 240 or 480 volts between any two Line-Wires	3 Line-Wires	THREE-PHASE MOTORS marked for 220 volts or 440 volts LIGHTS, APPLIANCES, HEATERS and SINGLE-PHASE MOTORS on 120 volts, 2 Line-Wire, or 120/240 volts, 3 Line-Wire thru transformer
	600 VOLTS	1875 Kva and Below	THREE-PHASE 600 Volts SINGLE-PHASE 600 Volts between any two Line-Wires	3 Line-Wires	THREE-PHASE MOTORS marked for 550 volts Lower voltages available thru transformer
HIGH VOLTAGE	2400	25 Kva and Larger	2400 THREE-PHASE between 3 Line-Wires	3 Line-Wires	SERVICE INVOLVING TRANSMISSION LINES usually generated at 2400 volts or higher
					SERVICE IN LARGE INDUSTRIAL PLANTS or INSTITUTIONS may also generate at high voltage
	2400/4160		2400/4160 THREE-PHASE between 3 Line-Wires	3 Line-Wires and one Neutral Wire	TRANSMISSION directly at generator voltage, or at a higher voltage through step-up transformers, depending on the distance of transmission. Approximate rule is 750 to 1000 volts per mile.
	6900		6900 SINGLE-PHASE between any two Line-Wires	3 Line-Wires	
	11,500		11,500	3 Line-Wires	MOTORS approximately 100 hp and larger can be operated at high voltage
	13,800		13,800	3 Line-Wires	MOTORS below approximately 100 hp, and other power, lighting and heating load are operated at low voltage through step-down transformers

* The Size Range shown above is for engine-driven generators. Range will vary from above for steam turbine driven and hydraulic turbine driven generators.
**For 50 cycle service neutral wire can be brought out to give Three-Phase, 400 volts between line-wires, and Single-Phase, 230 volts between line-wires and neutral wire.

Item 11—What Are the Possibilities of Telephone Interference?

This factor requires attention where the generators are to be operated in the vicinity of single-wire ground return telephones, which may be used on rural or oil field lines. Generators can be designed at extra cost for special low Telephone Influence Factor, or a tuning filter can be used.

Item 12—What About Flywheel Effect?

Providing proper flywheel effect for the engine is a part of the engine design. The flywheel effect should be such that (1) when the generator set is operated alone, cyclic variations will not cause light flicker, (2) when operating in parallel the imposed frequency and natural frequency of the sets must differ by 20% to avoid resonance, (3) when the sets are to be operated in parallel with a large power system the flywheel effect must avoid resonance of the system.

Item 13—What Provision Should Be Made for Parallel Operation?

Assuming that the electrical and mechanical characteristics of the engine-generator sets are correct for parallel operation, there are two principal additional requirements which must be met.

The first requirements is that kilowatt division of load (and corresponding engine horsepower) must be proportional to rating. Engine speed drops must be the same, and the kilowatt load must be proportionately divided to the prime mover horsepower ratings. This load division is a direct function of the engine governors.

The second requirement is that the reactive (magnetizing) component must be divided proportional to the generator ratings. To accomplish this the voltage regulators must be provided with cross-current compensation so that they will proportionately adjust the excitation of the generators.

Item 14—What Exciter Arrangement Will Be Used?

Practically all engine driven generators are furnished with individual exciters, either directly connected to the generator or belt driven from a pulley on the generator shaft. Direct connected exciters are utilized for the higher speed generators. For generators approximately below 900 rpm., belted or chain driven high-speed exciters are usually preferable because of the relatively high cost of slower speed direct-connected exciters.

Fig. 4—PEDESTAL TYPE GENERATOR. RATINGS: 250 kva to 5000 kva; SPEEDS: 1800 rpm and lower. For use with engine drive, and also for steam turbine drive through reduction gearing.

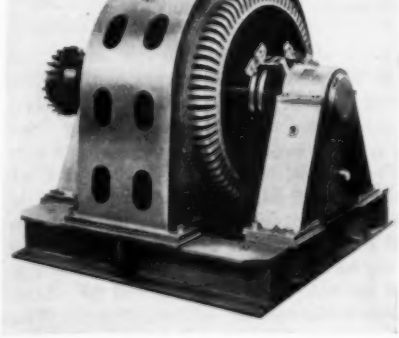
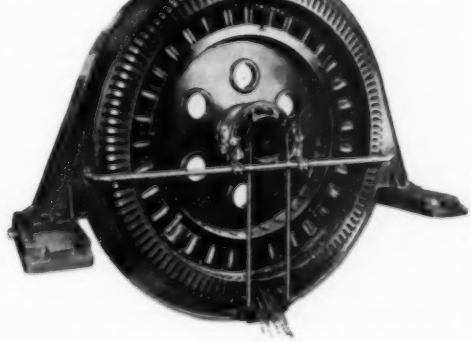


Fig. 5—ENGINE-TYPE GENERATOR. RATINGS: 31.3 kva to 8750 kva; SPEEDS: 450 rpm to 109 rpm. The engine-type generator consists of rotor and stator; the rotor is mounted on a shaft and bearing furnished by the engine builder.



Date-picking platform has just been hauled into place by Caterpillar diesel tractor. Newer models include hydraulic lifts.

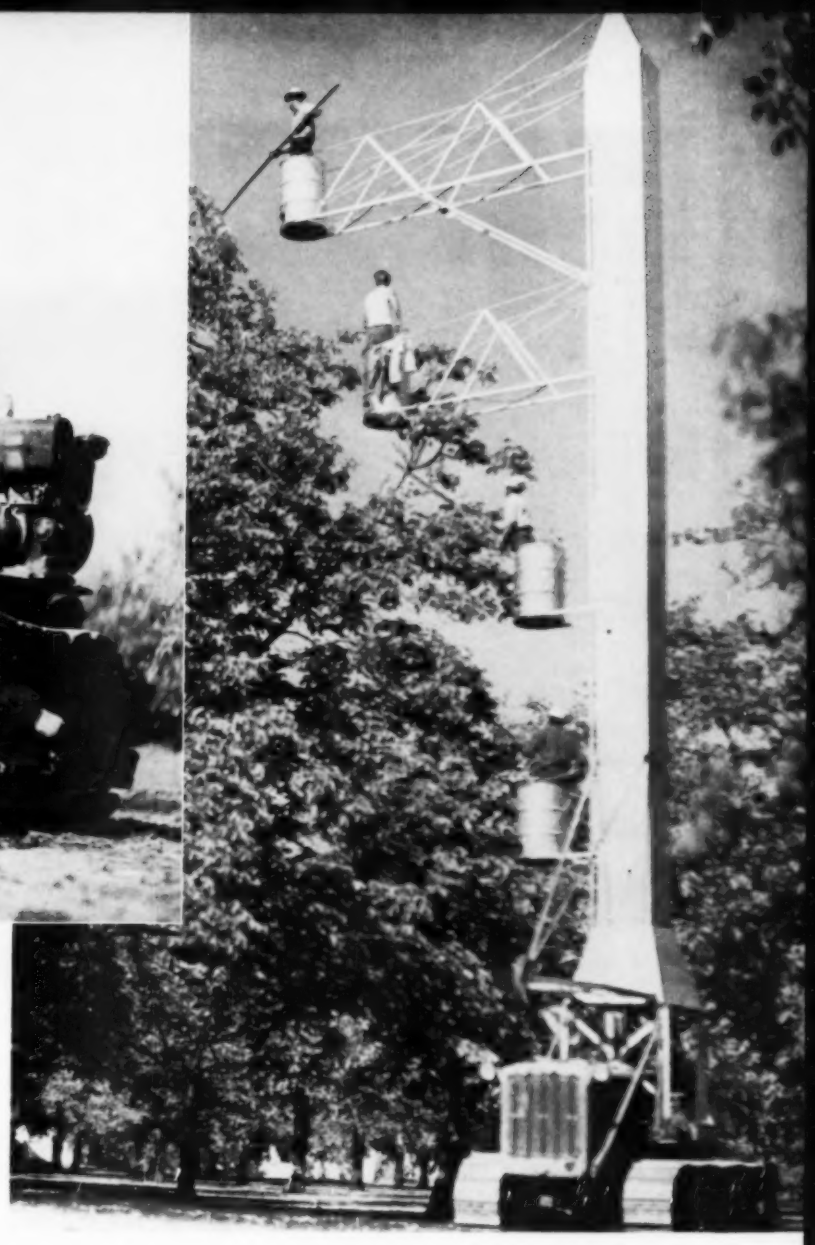
DIESEL TRACTORS GO HIGH HAT

THE diesel tractor is taking on a new job that gives it one more "dimension" in its varied works. For years farmers, contractors, loggers, dirt movers and oil field workers have marveled at the rugged diesel's work at the old reliable drawbar, or pull power. Then it took on power take-off and bulldozer, or push, power and got better at both to finally revolutionize war. Now and then in compacting fills and spreading and packing ensilage in pit silos it used its weight as packing power while spreading the material to be packed with a bulldozer on the tractor's nose. Now the walnut growers of central California are putting towers from 25 to 40 feet high over the cabs of the big crawler Diesels to carry men with knocking poles in buckets at 8-foot intervals up the tower to knock off the nuts as the tractor moves around a tree. It is really a sight well worth seeing, one which runs only in California.

This travelling tower idea for harvesting nuts and fruits started about five or six years ago in two different California areas: in the Coachella Valley date gardens, and in the prune orchards of the Santa Clara Valley. The shortage of tree labor during the war with increasing costs and poorer work was the big urge. In the date gardens two or three leading growers spent around $5,000 each on big steel towers that tractors could tow down the rows of trees to park in the center of four trees so that a pair of catwalks could be swung out to bracket each tree for eight workers to do the pruning, de-thorning, sulphuring, pollination, thinning and picking of the dates over the year's work. Soon, they were adding little engines to control the height of main platform from which the catwalks swung. This year, they have started junking the big unwieldy towers and replacing them with a telescoping date tower built by Travis Boone, a walnut tree tower specialist of ten years experience at such tools. These towers can be raised to 40 feet for the tallest and oldest trees and telescoped to 13' 6" for travel down the highway and through underpasses and other highway obstacles to taller structures.

Bowne's walnut knocking towers are in two sizes that fit onto tractors right over the cabs above the driver's head. For the average walnut groves, Boone builds a 3-man knocking tower of carefully engineered steel to permit the men to stand in oil drums with long poles and knock off nuts as the tractor circles a nut tree. For the larger trees, Boone goes to the big Caterpillar D7 with 40-foot tower and five men in oil drums hung on one side the tower with the two highest men hung out 6 to 12 feet from the chimney to reach over onto the top limbs of the tree. Thus

Mechanization of the prune harvest is well underway. Here Hercules engined Cletrac tractor equipped with metal tree-shaker "knocks 'em down".



(Right) Caterpillar crawler tractor with 40-foot walnut knocking tower enables knockers to reach highest nut-bearing branches.

By F. HAL HIGGINS

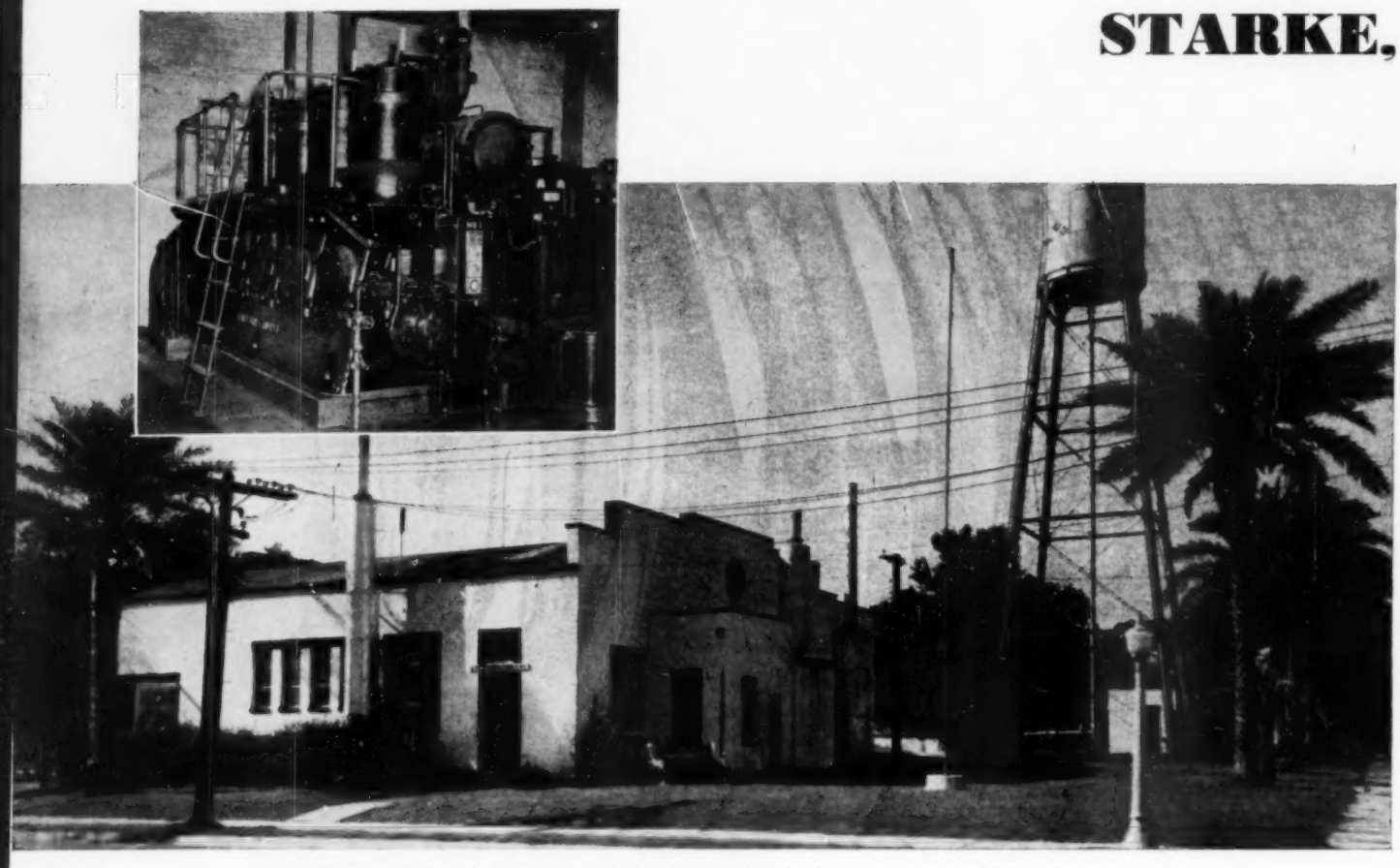
the bigger trees are easily covered as the big tractor slowly waddles around the tree. To see the tractor operate, one notes the men are as safe as if on the ground. There is no swaying or hint of tipping over because of the fine engineering job of construction and bracing achieved by Boone. He assembles his towers—one big one and five smaller ones—as the nut season opens in October. They then go out and do custom work for neighboring walnut growers.

Boone's demountable knocking towers for walnut harvest are as practical as brass tacks, agree both growers and University agricultural engineers who have been closely studying every ladderless labor fruit and nut tree idea starting to bud out on the California farm and ranch fronts. They all know they can't reduce hand labor rates much and an army of local and migrant hand-and-ladder labor must be brought into their orchards, groves and gardens every harvest season if the crop is to be harvested, processed and sent to market. Otherwise, a lot of tree fruits and nuts must be grubbed out and field crops substituted. In the past in pre-bulldozer days that was a $100-an acre job with a lot of time consumed in getting it done. Now the big diesel tractors with bulldozers shove out the prune, peach apple or other fruit and nut trees that have become economic liabilities at the rate of one every 2 minutes, piling them for burning after a few weeks drying out. But by eliminating ladders and reducing harvest costs 50%, many tree fruits and nuts can be kept in the profit column of farming to give the public both its fruit and nut places in the daily diet, while eliminating the hand labor and shifting it to more stable and safe occupations. Insurance on farm labor can be reduced, too.

The University agricultural engineers sum up the big advantages being achieved already at this embryo stage in the development of ladderless labor in tree fruit and nut farming as these:

1. Cut of cost of production up to 50%.
2. Elimination of most of the migrant labor in favor of stable labor with year-round work and residence on the farm or nearby.
3. Less accidents and lower insurance for hired labor.
4. Higher quality of product for top market from less bruises and more timely harvest of fruit and nuts.
5. Earlier work by machines with local labor as result of not having to wait for labor to arrive and hauling out of ladders, etc., to orchards.
6. Night work in orchard by lighting the machines on which labor works.

STARKE,



View of Municipal Light and Water Plant at Starke, Florida. Inset shows diesel unit No. 1, a 300 hp Fairbanks-Morse diesel installed in 1938.

STARKE, Florida, the County Seat of Bradford County, located 40 miles south of Jacksonville, is the shipping point and principal trading center for the second largest strawberry and truck farming area in the state. Always a progressive town, Starke was among the first to install an electric plant. The first plant, a small direct current generator driven by a steam engine, was installed in the waterworks in the year 1903. A larger steam plant was installed in 1912, but the current generated was 220 volts DC and line losses were high and no standard appliances could be used. Operating cost of the plant was high and it was operated only at night, service was poor and the steam plant was operated at a loss to the town, even with a rate of 30c per kw. hr. for current. It was necessary to levy a tax of 2 mills for "Plant Operation."

By the year 1922 the old steam boilers were in bad condition and machinery in the plant was continually breaking down, voltage was very low in many parts of town, the distribution system was in bad repair and overloaded. A survey made in that year showed that line losses were more than 55 percent of the total plant output.

In 1922 the largest steam engine "ran-away" and completely wrecked the largest generator, leaving the town completely without power as the small engine could only carry the street lights. After considering the cost of repairing the old steam engine and operating the steam plant at a loss, the Board of Bond Trustees compared the cost of operating oil engines with steam and decided to float a new $50,000 bond issue and sell the old boilers, steam pumps and generators and install two 100 hp. oil engines with 2300 volt generators and rebuild the distribution system for alternating current. Fairbanks-Morse & Co. were low bidders on the engines and generators and placed the first engine on the line in January 1923.

After selling all the old steam equipment there was still indebtedness on the steam plant amounting to over $45,000, and a total indebtedness on the light plant of over $95,000 at the start of diesel operation. Much credit for the success of Starke Municipal Light Plant is due to Mr. J. T. Quigley, the late Major J. L. Peek of Starke, Mr. George White, now City Clerk of Tallahassee, Fla. who at that time composed the Board of Bond Trustees, and to the late Mr. Robert F. Clark, Superintendent from 1922 until 1940.

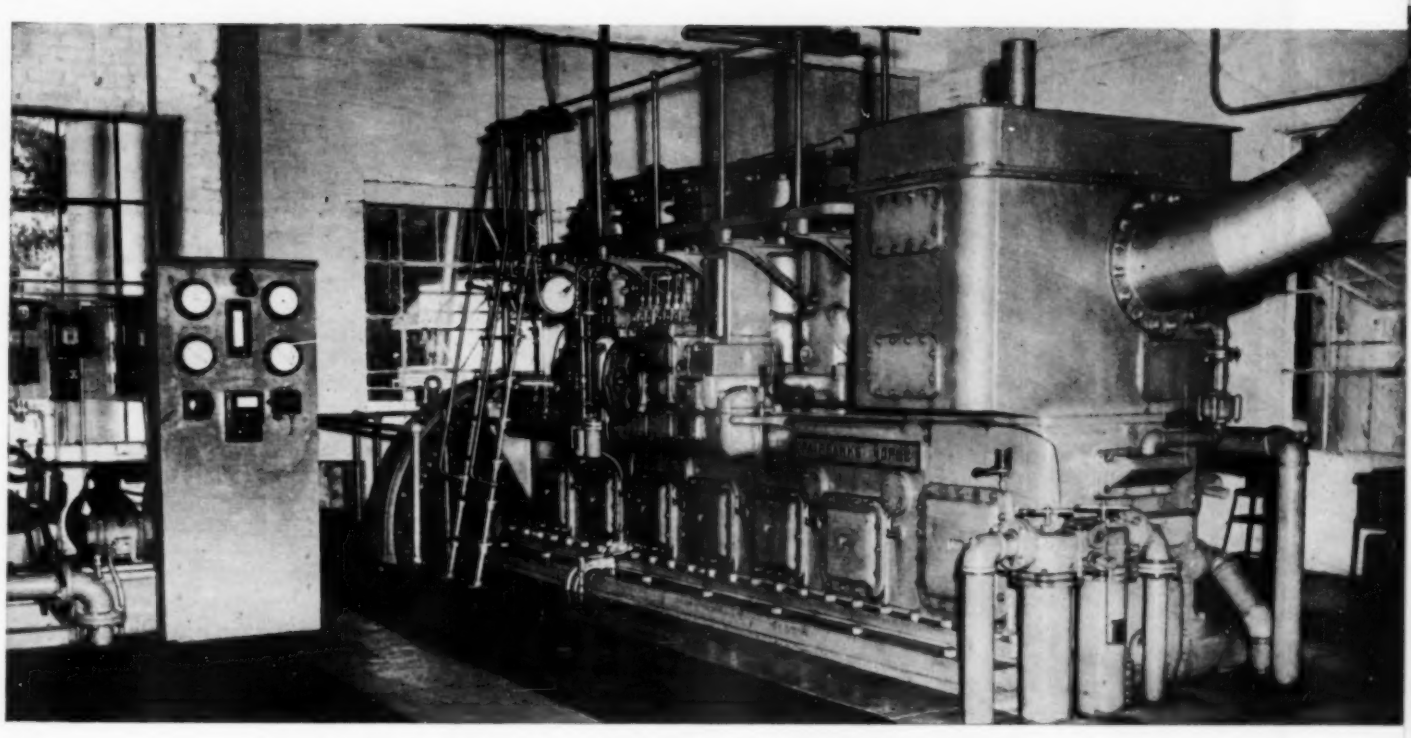
As soon as the two oil engines were installed the plant was placed on 24 hrs. per day operation and as the load started to grow rates were reduced, and as standard appliances could be used, some new homes were constructed by the year 1930.

The plant was becoming overloaded, and as the plant was now a paying concern all millage for plant operation had been dropped. Because $10,000 of the debt on the old steam plant had been paid off and the entire $50,000 bond issue had been retired, it was decided to install another unit of 150 kw. capacity. Fairbanks-Morse & Co. were again low bidder and a 240 hp. full diesel directly connected to a Westinghouse 150 kw. alternator and 10 kw. exciter was installed. At this time the old plant building was in bad repair and a new modern brick building was erected over the old plant, and the old building torn out. About this time the well remembered depression started and the citizens of Starke began to appreciate public ownership of their light plant, for as town after town in the State defaulted on their bond payments, Starke never missed having the money when any interest or principal payment became due. There was always enough money in the light plant funds to transfer to meet current obligations of the plant.

By 1938 load on the plant had again increased to the point where it was necessary to install an-

FLORIDA

By BERRY S. JOHNS*



No. 2 unit installed in 1946 is a 690 hp. Fairbanks-Morse diesel which operated 4773 hours during 1947.

other unit. Fairbanks-Morse & Co. were again low bidder on a 300 hp. 200 kw. unit, at a cost of $30,750 for above unit and heat exchangers. Maxim silencers for the old units were also installed.

It would appear that the plant was well equipped to care for the town's electrical requirement for years to come as the plant now had a capacity of 410 kw. and a peak load of only 160 kw. At this time rates were again reduced, and electric demand continued to increase slowly until the spring of 1941, when with the start of construction of Camp Blanding located only 6 miles from Starke, the town was swamped and overflowed with construction workers and their families, and a large number of new stores and new homes were built in Starke in that and the following year. Some idea of phenomenal growth of the town, can be obtained from the number of new water and electric services installed. The total of electric meters in January of 1941 was 366 compared with 978 in January 1943 and with the peak electrical demand of 160 kw. compared with the peak demand of 660 kw. in the year of 1943.

The total kw. hrs. output for January 1941 was 47,910 hrs. compared with output of 258,374 kw. hr. in January 1943.

*Supt., Starke, Fla. City Light & Water Plant.

As it was impossible to install another unit in time to care for this sudden increase in load, an agreement was reached with Clay Electric R.E.A. Co-op at Keystone Heights, Fla. to build a 12 mile line from their plant to the Starke City limits and for the city to build a sub station with power to be purchased by either party under a power exchange agreement at rate of one cent per kw. hr. with two-way metering. This arrangement has been in operation for almost seven years and has worked well as the peak loads on the plants do not occur at the same time. It is possible to level out some of the low demand periods and operate units at almost full load at all time with a saving in fuel and lubricating oil. At present, the engines are operated in the Starke plant at full load, and at all times they are on the board. Balance is taken from the R.E.A. plant, which gives a very high output per gal. of fuel oil.

As soon as available after the end of the war, the latest unit, a 690 hp. Fairbanks-Morse diesel generating unit of 473 kw. capacity was installed and placed in operation in March 1946. Cash was paid for this unit out of plant earnings.

•This unit replaced one of the original semi-diesel units which was installed in the year 1922. Both these old units are still in operation—one in an ice cream plant in Richmond, Va., the other in an ice plant in Starke. They were still in good condition when replaced but the town had outgrown the capacity of these engines.

With the profits from the plant it was possible to sponsor a number of W.P.A. and P.W.A. projects including a new City Hall, American Legion Hall, National Guard Armory, Farmers Market, and additions to waterworks system and modern sewage disposal plant and a collection system installed at a cost of $290,000 under Federal Works Agency War Public Works.

With the retirement of $50,000 of revenue issued bonds to build the waterworks and sewage project, the city is now free of all bonded indebtedness and is operating on a cash basis in all departments.

Starke has a paid fire department, two modern pumpers with one man on duty at all times, four member police department; three garbage trucks; modern road grader; angle dozer and other street maintenance equipment including power mower and street sweeper.

Business property is taxed 15 mills; no tax on homesteads with assessed valuation of less than $10,000.

Diesel trucks dump iron ore at the other end of conveyor belt to be carried to this automatic stacker at the stockpile.

DIESELS ON THE "FLYING EAGLE"

By FRED M. BURT

THE new, privately financed, $17,000,000 expansion program at Henry Kaiser's Fontana (Calif.) steel plant adds greatly to the demand for the in-pouring of iron ore in large quantities.

The new blast furnace, the second of its kind, will provide an ultimate potential pig iron capacity of 876,000 net tons from both furnaces. The new battery of 45 Koppers-Becker coke ovens, added to the present two batteries of 90 ovens will increase the annual coke oven capacity to a rated 515,000 net tons. All to be completed in the year 1949.

There is considerable diesel transportation equipment at the plant, but in this article we are concerned with the part that diesels play in supplying the greatly increased demand for iron ore. In the words of Henry Kaiser, "The final integration of this ore supply with the production pattern of Fontana will mean the West has taken another step on its way to an independent, competitive steel industry."

In Riverside County, the Joshua Tree National Monument area includes the Eagle Mountains, now called the "Mesabi Range of the West." Here just before the turn of the century, two Dorfmeyer brothers discovered gold. They called it the "Iron Chief" mine because of the heavy content of "worthless" iron, and finally gave it up because too much iron ore had to be handled to get at the gold. Since that time it has been idle, awaiting its present vital use.

To connect with the Southern Pacific (for a total rail haul from mine to mill of 165 miles), at Ferrum on the Salton Sea, 190 feet below sea level, the $3,800,000, 52-mile, "Flying Eagle" railroad was built in 11 months under almost insuperable handicaps. A wide variety and large quantity of heavy-duty diesel earth-moving and transportation equipment made possible the early and satisfactory completion of the job.

It is the only privately built, standard gauge railroad constructed in this country since 1926. Part of it was built under desert temperatures up to 125 degrees. From its terminus at Ferrum, it parallels the old Butterfield stage trail, crosses the All-American canal, and spans Salt Creek on a 550 ft. trestle where flash floods have created water run-offs as much as 20,000 cubic feet per second. It cuts across Desert Center, scene of General Patton's armored divisions training ground, then up over a maximum altitude of 1658 ft. above sea level, to the Eagle Mountain mine operations.

Baldwin 1500 hp. diesel locomotive about ready to take off with 28 car train of 60 ton loads.

The twenty-eight carloads of iron ore, 60 tons each, delivered daily to the Southern Pacific, are handled easily and quickly with a 150 ton, Baldwin locomotive, powered with an eight cylinder, 1500 hp. diesel engine.

The "Iron Mountain Mine" (official name) doesn't look like a mine. It is just a range of hills, containing untold millions of tons of iron ore, in the desert sand, with that ore running as high as 54% pure iron.

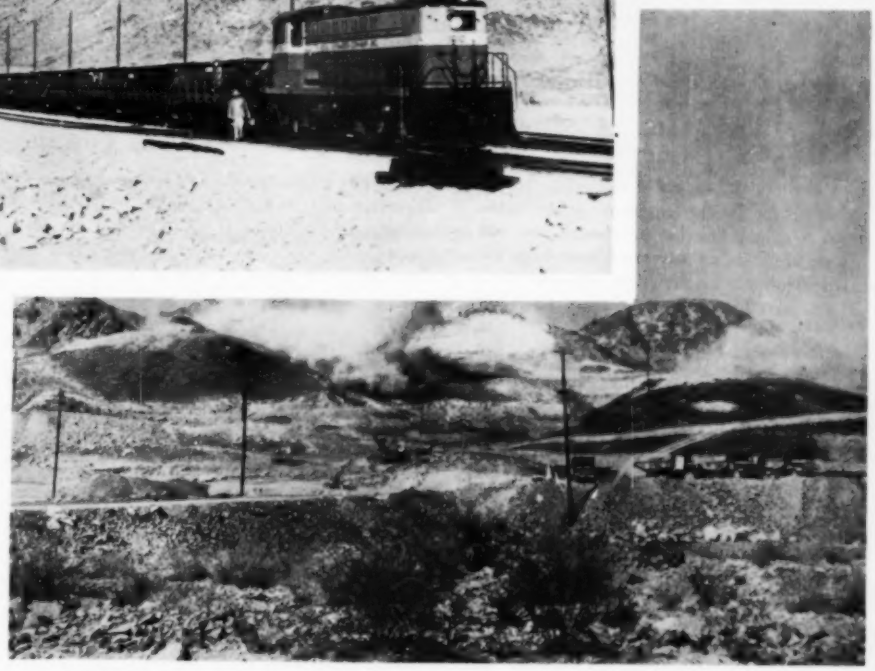
Charges of high explosive, tons at a time, loosen thousands of tons of iron ore from the face of the mine. Lying close to the surface, it can be mined by the open-pit method after the top earth is removed with D8 "Caterpillar" diesel tractors equipped with heavy duty cable-powered dozers.

In preparation for blasting, workmen with pneumatic drills bore into the iron ore. The deeper blast holes are made with large churn drills. Air for drilling is supplied by four portable compressor units, two 500 cfm. Ingersoll-Rands powered with Waukesha engines; one 500 cfm. and one 365 cfm. Gardner-Denvers with "Caterpillar" diesels.

Two 54-B Bucyrus-Erie shovels with 2½ cu. yd. buckets, powered with Buda diesels load the shattered ore into 10 cu. yd. Euclid end dump trucks powered with Cummins 150 hp. diesel engines. The trucks dump onto a 42 in. belt conveyor, in two sections totalling 375 ft. length, 690 tons per hour capacity, for carriage to the stock pile. Another 32 in. belt, 1250 tph. capacity, 200 ft. conveyor picks up ore at the stockpile to load it in the railroad cars. The conveyors are electric powered and controlled for automatic operation.

Mine workers and their families are housed in a modern settlement atop the mountain range, with new diesel-built roads providing easy access to the homes and to the mining operations.

When the enlarged facilities at the Fontana plant are completed, two trainloads a day will be delivered by the Baldwin diesel locomotive. Thus diesel-mined and diesel-delivered ore will keep the Kaiser plant self-sufficient for decades to come.



Diesel shovel and Euclid diesel-driven dump trucks ready to remove blown away iron ore to stockpile.

Air view of Kaiser's Iron Mountain mine with diesel-graded roads, diesel driven dump trucks and shovels, conveyors, stockpile and train.

DIESELS TAKE OVER IN LOGGING

By HAL QUINLAN

DURING the last 15 years, important changes have occurred in the logging industry in the Pacific Northwest. Equipment has increased in size and mobility; the industry has been freed from the limitations of railroad and water transportation; and new areas have been opened to economical logging operations. Diesel engines have played an important part in making possible all of these changes.

Since logging is chiefly a problem in transportation, in the pre-diesel years it was impossible to log economically in regions not easily reached by railroads or waterways. Compact, low weight, high-speed diesel engines have changed this situation. Since their introduction, logging operations have penetrated deep into hitherto inaccessible valleys, and have moved farther up steep mountainsides.

This Mack truck is one of 14 diesel rigs used by Weyerhauser Timber Company on its Molalla, Washington, show. Trucks handle 90,000 to 100,000-pound loads of logs, 40 to 48 ft. long

A. J. Barrett, Valsetz, Oregon, uses this Autocar, Cummins-engined tractor and semi-trailer on hauling contract for Western Logging Company.

Washington "Trakloader", background, loading a Kenworth truck on the Grisdale logging operation of Simpson Logging Company, Shelton, Washington. Both units are powered with Cummins diesels.

In this spectacular view, are seen a Kenworth truck, Skagit yarder and loader, all Cummins diesel-engined at Soundview Camp 18 operation of Soundview Pulp Company, Everett, Washington. These are but three of 32 pieces of Cummins-engined equipment operated by Soundview.

A Tyee conversion yarder powered with Cummins diesels, one of 75 Cummins-engined equipment operated by B. C. Forest Products, Ltd., Vancouver, B. C. in its 11 logging camps.

A 24-ft. portable circular mill, powered with 3 Cummins diesels producing 45,000 bd. ft. daily for Portable Lumber Mills, Inc., near Roy, Washington.

The use of high-speed diesel engines has made it possible to salvage timber that otherwise would never have been loggd. Today, loggers are returning to tracts that were passed over during previous operations, and are logging these areas profitably with diesel-engined equipment.

Diesel engines enable logging trucks to carry 80 to 100-ton loads up 12 to 15 per cent grades, and to operate empty on grades up to 35 per cent. Round trips of 40 to 50 miles are common. Diesel trucks work at least nine months a year, and operate under conditions that made logging impossible when the industry was dependent upon rail and water transportation. Often, these trucks work double shifts.

On log-hauling jobs, diesel engines have proved their complete superiority over gasoline engines, both in terms of cost and performance. Diesel logging trucks carry heavier loads, make the steep grades a full gear higher, and do more work where the going is tough and the ground is steep. For example, on one job, diesel engines made possible an increase in the number of trips per day from the original five per truck to six and more.

In yarders, diesel engines furnish the power required to bring the big logs out of the woods fast. Powered with single or dual-engine drives, yarders operate successfully on sides where the distance between landings is 2,000 feet or more. Diesel engines enable them to snake 80-foot logs out of the woods on the steepest mountainsides, and give them the speed and acceleration to bring the rigging back into the woods fast.

In loaders, diesel engines offer the advantages of power and flexibility. They furnish the power required to hoist an entire load of logs onto a truck or railroad car at one time; to swing an entire load off a truck in one operation; have made possible the utilization of economical pre-loading methods.

Diesel engines have also made possible increasing mobility in yarders and loaders. Trucks are used to transport these units from one side to another, and, during recent years, diesel yarders and loaders have been built as self-propelled units.

Diesel engines also have established performance and cost records in marine use in the industry. They power "marine bulldozers" that boom logs into huge rafts, as well as tugs that tow or push the rafts along inland waterways. One of these small tugs pulls loads of 500 to 600 cords of wood on a river against the current. Another, working where there is little or no current, pulls approximately 5,200 cords of wood at an average speed of one-half mile an hour. This type of diesel-propelled work boat sometimes tows huge rafts that include as many as 25,000 logs.

The experience of sawmills and planing mills proves that diesels offer many advantages over any other type of power. Diesel engines make possible the production of increased footage at lower cost, and offer savings in terms of reduced fuel and maintenance costs. They have the ability to work from eight to 16 hours a day week after week with the very minimum of down-time. And one diesel engine can power many pieces of equipment, including saws, edgers, blowers and conveyors.

Diesel engines also made possible the development of today's portable sawmills. With individual units mounted on sleds, portable mills are moved into hitherto inaccessible stands of timber for profitable lumbering operations. Such units handle smaller logs than could be sawed profitably at a stationary mill, and make possible the retrieving of as high as 25 per cent more lumber from a stand. Portable sawmill operation saves log transportation costs, and reduces the expense involved in transporting and setting up the plant.

Ever since diesels were introduced into the Pacific Northwest, diesel-electric generating sets have been used to furnish power for lights, machine shops, and other equipment. The recent power shortage in the Pacific Northwest has increased such use, not only in isolated logging camps, but also in sawmills and planing mills that normally depend upon electrical power. In such use, diesel engines have proved their ability to furnish economical power, but, what is more important under the circumstances, they have made sawmills and planing mills self-sufficient as far as power is concerned. Until the introduction of diesel-electric power, many mills were faced with the threat of being forced to close down completely.

What's ahead for diesels in the logging industry? Logging units, including trucks, yarders, loaders and other equipment will continue to increase in size, and there will be a continued increase in mobility of all types of equipment. This trend calls for more powerful diesel engines, engines whose low weight per horsepower and ability to produce more at lower cost will enable them to continue to lead the field in the logging industry.

FIRST ALL DIESEL-ELECTRIC DINING CAR

THE idea of an all-electric diner is not new to the Illinois Central. Plans and designs for such a car were worked out by the Mechanical and Dining Service departments of the railroad, in cooperation with the General Electric Company, as long as three years ago. The recent delivery of the new all-electric diner, carrying its mobile powerhouse, marks another milepost in railroad progress.

The power equipment includes complete generating and power conversion apparatus. It consists of two Buda diesel-electric generating units for furnishing 220 volt, 3 phase, 60 cycle power; an associated heat recovery apparatus for heating water by means of engine exhaust gases; a motor generator set with a 220 volt, 3 phase, 60 cycle motor and DC generator for battery charging; and all the necessary equipment for controlling and regulating the operation of all apparatus.

Each of the power plant assemblies consists of a housing or inclosure arranged for under-car mounting and containing the diesel engine directly connected to the alternator, complete with exciter and voltage regulating control. The set is mounted in the housing in such a manner that it can be pivoted to the outside beyond the edge of the car for servicing without making any disconnection other than that of the exhaust pipe. Provision is also made for removal of the engine-alternator set while in the swung-out position, and mechanical interlocking insures a secure position of the set in operating position before covers can be closed and fastened. When in normal operating position, the set is carried on vibration dampeners mounted inside the housing.

A propeller-type blade, or fan, mounted on the engine furnishes ventilating air for the alternator, and a separate radiator unit, complete with motor-driven fan, is provided for each power plant, the operation of the fan motor thermostatically controlled by the temperature of the engine jacket water.

A heat exchanger is provided to heat water for kitchen use: the exhaust gases from each engine pass through a flexible connection to a muffler, after which they pass through a transfer valve which transfers them either to the exchanger or to atmosphere under control of a thermostat in the hot-water tank.

The motor-generator set is normally driven either from the 220 volt alternator of the engine-alternator set or from 220-volt AC wayside power and furnishes DC power for battery charging and for control, with the DC output regulated by a voltage control relay. It may also be used for inverted operation, taking power from the battery and furnishing power for lighting, ventilating fan and coffee urn. While the set is operating inverted, the battery-charging regulator is disconnected, and special resistors with a negative temperature coefficient are connected into the DC motor field circuit. Thus a fairly constant speed is assured and an essentially constant AC voltage output obtained.

The total electrical load of the dining car has been divided into: (a) the essential load, consisting of lighting, battery-charging, refrigeration and coffee-urn requirements, and (b) the air-conditioning and cooking load, with the essential load normally supplied by alternator No. 1 and the remainder from alternator No. 2.

The control equipment, consisting of contactors, current transformers and fuses mounted in two control cabinets and of instruments, relays and switches mounted on a main control panel, is arranged to divide the total load into two classifications for normal operation and to perform other functions as follows:

1. Provide for starting and stopping the diesel engines independently.

2. Provide for starting and stopping the motor-generator set for either normal or inverted operation and with automatic phasing in and synchronization with the engine-generator set selected.

3. Provide for disconnecting the air-conditioning and cooking load in case of failure of an engine-generator set, automatically maintaining the essential load or, if necessary, transferring it to the other remaining set.

4. Provide for inverting the motor-generator set operation to supply power for the essential load from the battery in case of failure of both engine-alternator sets. A reverse power relay prevents the motor-generator set from supplying power to any load other than the essential load under this condition.

5. Provide plug-in facilities for standby power with provision for preventing the paralleling of standby power with power from an engine-generator set.

6. Provide overload protection for the control circuits, alternators and motor-generator set with automatic reset in case of temporary overloads for each of the alternators and hand reset in case of a sustained heavy overload.

7. Provide for measuring battery voltage and the AC voltage of each of the alternators and of the motor-generating set.

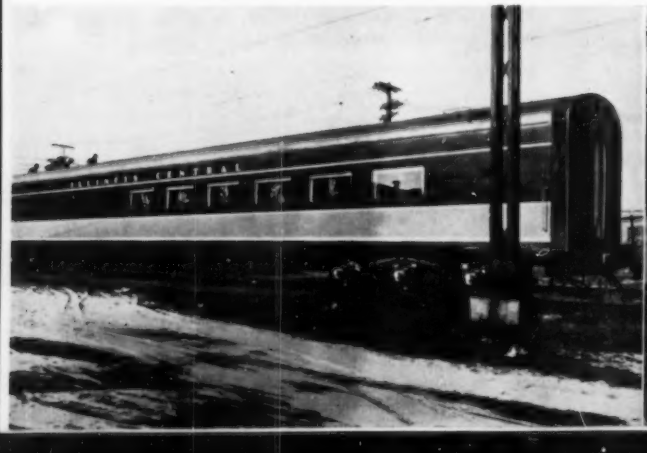
8. Provide for the voltage regulation of the DC output of the motor-generator set. The main control panel is arranged for mounting inside the car, while the two cabinets are designed for under-car mounting.

This is the first dining car of its type to be built for revenue service on any American railroad. It is an adaptation of the electric galley developed for the United States Navy for cooking on submarines. The diner is the joint product of the General Electric Company and the Mechanical and Dining Service departments of the Illinois Central Railroad and was constructed in the railroad's Burnside Shops at Chicago.

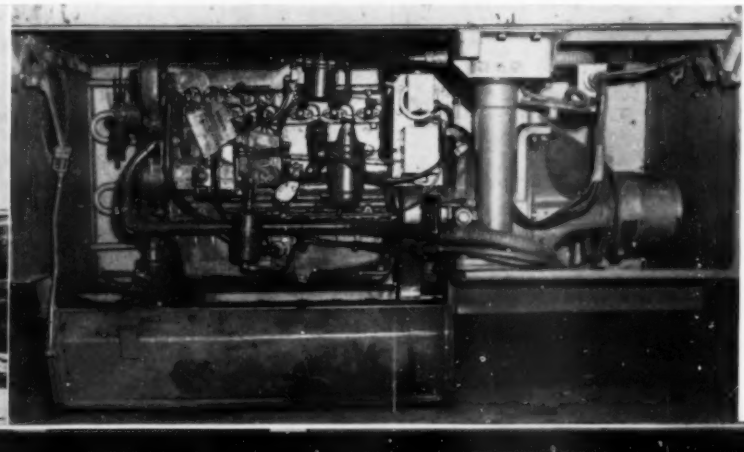
In talking about the features of the new dining car, N. L. Patterson, general superintendent of dining service, pointed out that the railroad has been using bituminous coal, oil and gas as fuels in dining car kitchens. "Our experiments with electric cooking and the development of the all-electric diner lead us to believe that we may have reached a solution to many of the troublesome problems that are experienced in cooking in confined areas," he said. Mr. Patterson called particular attention to the freedom from cooking heat, smoke and soot, explaining that electricity will simplify the problem of cleanliness and improve the working condition of dining service employes.

The new diner is veritably a rolling powerhouse, supplying approximately 50,000 watts, the equivalent of the power output of a major radio broadcasting station.

Full view of the first all diesel-electric dining car.



One of the two Buda diesel-electric generating units for furnishing 220 volt, 3 phase, 60 cycle power.



Diesel Train TALGO

WHAT can happily be labelled as the first train ever to be built in America based on the Spanish "Patentes Talgo" has been completed by the American Car and Foundry Company. From January 2, 1946, the actual commencement of the engineering plans, to this present date, no expense or research detail was spared to evolve such a diesel streamliner out of the skill and experience that U. S. builders and suppliers have developed since the dawn of the streamliner era fourteen years ago. Constructed at the Berwick, Pennsylvania and Wilmington, Delaware plants, this revolutionary streamliner is the first of three such trains; the other two destined for revenue service in Spain between Madrid and the French border to connect with trains to and from Paris. This distance the Talgo will travel is 400 miles.

The locomotive problem in connection with the Talgo train is interesting in that a diesel-electric locomotive is required combining low weight per axle with comparatively high diesel horsepower together with exceptionally good tracking qualities on both tangent track and curves, plus many other characteristics. Obviously, if this problem had not been solved satisfactorily, most of the advantages of the lightweight passenger units would be lost. Therefore, in the early stages, many possibilities of achieving the desired result were examined.

General Data and Dimensions

Type .....B-B Diesel-electric
Control .....Single End
Horsepower, total .....1150 hp.
Propulsion—Two, V Type, 8 cyl. supercharged automotive type diesels..each 405 hp.
Auxiliary—Two, 6 cyl.-in-line, automotive type diesels .....each 170 hp.
Engine Mounting .....Rubber
Number of Traction Motors 4
Speed .....Geared to 105 mph.
D.C. Control Voltage .....75 v.
Battery .....32 cell
A.C. Supply (Train and Loco.) ..... 208/120 v. 3 phase
Air Brakes .....Straight Air
Braking Power ....250% @ 100 lbs.
Fuel Oil Capacity .....600 gal.
Water Capacity (For Train Service) .....300 gal.

The cab structure is an all-welded design of girder type designed to keep deflection to a minimum. The latest metallurgical processes were used to reduce welding distortion and creep in the assembly of each cab.

The side panels are 3/16 in. RVE-Plymetl with 24 gauge zinc-coated steel on both sides. The end sections are ⅛ in. OHS plate. Anti-crash and collision protection is provided in the nose by the use of tubular members in each unit.

Twelve in. LAHT channels are spaced 42 in. apart from the center sills and only one crossbearer is used. The exceptionally wide spacing was made in order to permit the main propulsion engines to be suspended as close to the rail as possible. Welding was used throughout, and the entire underframe structure is stress-relieved. The structure is designed to resist a 50,000 lb. buffing load applied at the 15⅜ in. coupler height required by the Talgo cars.

As the locomotive is required to operated permanently as part of the train only one operator's compartment is provided. A headlining of perforated metal is applied over the entire roof section which together with a well-insulated partition reduces the noise level to a minimum.

The main propulsion engines consist of two Hercules diesels connected to the traction generators through a ventilated bell housing. The auxiliary engines consist of two Hercules diesels direct-connected to the auxiliary alternators.

The General Electric d-c electrical propulsion equipment consists of:
2—GT-570-B1 traction generators
2—GMG-146-B3 exciter-auxiliary generators
4—GE-753 traction motors with axle gear
1—Set of single end, single unit control

All auxiliary power, except battery charging, for the locomotive and train is alternating current and is supplied by two General Electric 168 hp., 1500 rpm., 50 cycle, 208/110 volt, 3 phase alternators.

The most important points of any new locomotive are those features which differ from established practice. In the U.S.A. a definite practice has been established for road diesel-electric locomotives. The following paragraphs mention the difference between the ACF Talgo locomotive and standard type locomotive.

The low weight per horsepower is primarily the result of using light weight diesels of approximately 13½ lbs. per horsepower, and, of fabricating many of the car frame members from low-alloy high-tensile steel into a compact design.

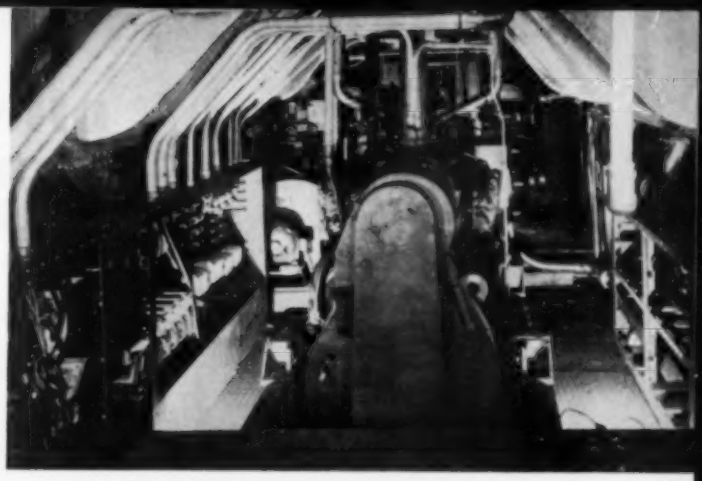
The exceptionally wide range of speed-tractive-effort performance (17 mph. to 105 mph. without exceeding the continuous rating of the traction motors) is the result of using two extra heavy-duty motors with each of the 405 hp.-input generators. The installation of four diesels (two main engines for motive power, and two auxiliaries for 110 v. AC power) provides availability heretofore unattainable in a single locomotive as the train can be operated using one main engine and one auxiliary in the event of emergency.

An interesting and practical method for the removal of the motive power diesel generator assemblies is available to maintenance men in the 42 in. wide open center sill construction. With the use of pit type elevator systems, both main diesel units can be replaced in their suspensions with a minimum of time and effort.

Rubber-in-shear engine mounting units, probably the largest ever used in locomotives, practically eliminate vibrations in the structure. As flexible metal hose, rubber hose and flexible wiring have been used for the engine connections, complete power plant isolation has been achieved.

A braking system was evolved which incorporates a 250% braking ratio and speed control of the straight air braking to provide smooth quick stops for the lightweight Talgo train.

A Westinghouse air brake is used on the Talgo, while a manual throttle operation controlling both engine speed and reversing with one lever is made by General Electric.



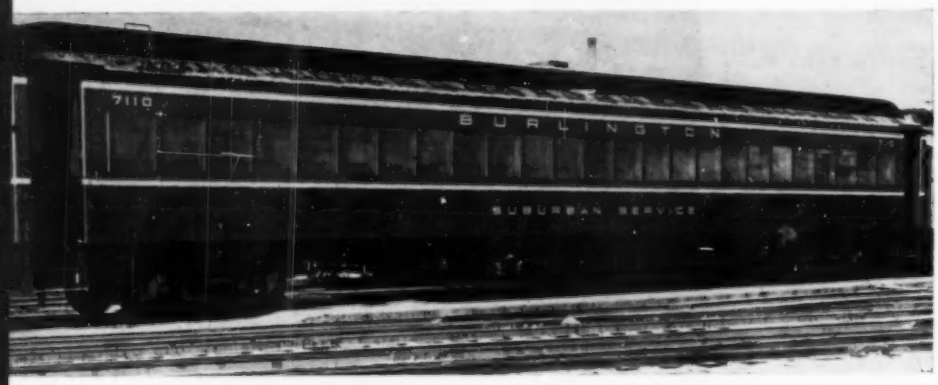
One of the two 405 hp. supercharged Hercules diesels directly connected to a G-E generator.

Interior view of the last unit and observation car.

Full view of the streamline train Talgo.

BURLINGTON DIESELIZES COMMUTER SERVICE

By CHARLES F. A. MANN



First phase of modernization is to refurbish coaches such as this.

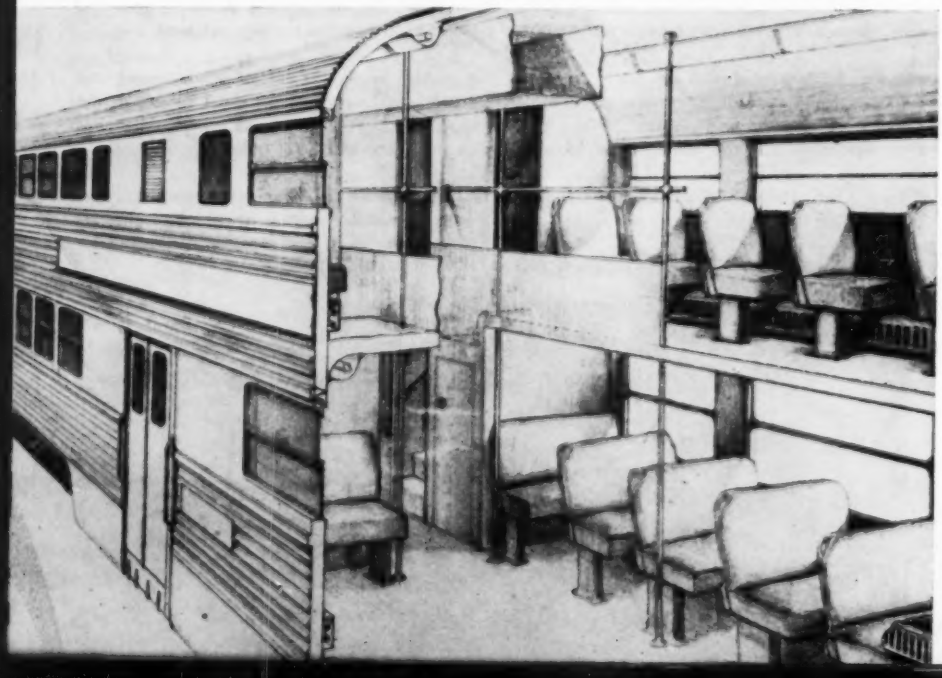
THE Chicago, Burlington & Quincy Railroad, America's No. 1 diesel pioneer, recently announced that it was pushing ahead rapidly a program to dieselize and modernize its entire suburban service.

The Burlington's main line goes almost straight West from Chicago's big, dirty Union Station—West to the Pacific Coast. In a 50 mile belt on both sides of the track the Burlington bisects one of the most fruitful commuter zones in the Chicago area. By ingenious signalling and extensive use of remote control switches, it has, in effect, a 4-track line through the commuter zone, with but three pairs of track. Mornings, eastbound, two tracks are used, and one westbound. At night, during the rush, the track and signal layout is reversed to give two westbound lines and one eastbound track.

Traditionally, suburban service on the Burlington has been the butt of many national jokes. Because it originally served, a proud, but purse-pinching middle class type of commuter, often the victim of every rise and fall of business curves, it has been strictly a deficit operation. Its open-end, very long, non-air conditioned coaches, the fleet of old Light Pacific's, its being a part of the old commuter-hating J. P. Morgan railway empire, gave rise to a polite, but perennial Long Island feud between the railroad and the suburbanite, stretching back a half century. Neither side yielded.

Now, under the astute leadership of Ralph Budd, America's "President's President," in the railroad industry, the Burlington has finally decided to junk every old tradition and approach the commuter problem realistically. People have to have commuter service in large metropolitan cities. That's that.

Second phase is the addition of stainless steel "gallery type" coaches as shown in this drawing.



The Burlington proposes to modernize and revamp its entire service; scrap most of its old steam teakettles; speed up and even out the whole commuter train picture; install nice seats; good light and air-conditioning, then ask the commuters to help foot the bill. But get the picture; only after —not before—the improved service is in operation.

First part of the program is completely to rebuild the suburban coaches it now has. Some 65 are being revamped and stripped down to their running gears at the Aurora shops of the Burlington. Then they are moved to the Havelock, Nebraska, shops for new steel work, and returned to Aurora for finishing. New steel work calls for vestibules, trap doors, air ducts, diaphragms, tail gates, etc., on these 96 passenger cars. Tight lock couplers, clasp brakes, rubber draft gears, etc., are being applied. Fibreglas insulation; soundproofing and fin type steam heat coils on the floor; new electric wiring and a new type ice-activated air conditioning system will be fitted.

Because the relatively short time during the day these cars carry loads, and long layovers after short runs, time will be available for loading the ice bunkers at terminals. Dual windows will be installed and the seats reupholstered in plastic. With improved lighting and forced air ventilation and air conditioning, the suburban cars will be vastly more comfortable and quiet than when they were the open vestibule type of glorified trolley car.

For Chicago's hot summer season, 1800 lbs. ice capacity will cool the water-activated cooling system. No batteries will be used on the cars, as all power will be head-end equipped, probably from the new locomotives.

Second phase of the Burlington's $8,500,000 suburban diesel program consists of outright brand new stainless steel coaches. The Edward Budd Co. of Philadelphia will build the unique stainless steel cars, from designs worked out by Burlington & Budd engineers. They will be of the "gallery type" seating a total of 145 passengers, 93 on the main floor and single seats for 26 on each side in "gallery" seats along each side. Double center doors replace the conventional end doors, and in construction and appointments they will rank with the best of the new Zephyr coaches. Plans call for use of the big, high-capacity cars throughout both slack and rush hours, and filling in with the rebuilt conventional cars during the morning and evening rush periods.

The diesels consist of special type EMD 2000 hp. locomotive units, with head-end power plants and ample heating boiler capacity. During rush hours about 20% of the motive power load will be carried by steam, but during the non-rush periods the entire service will be 100% diesel operated.

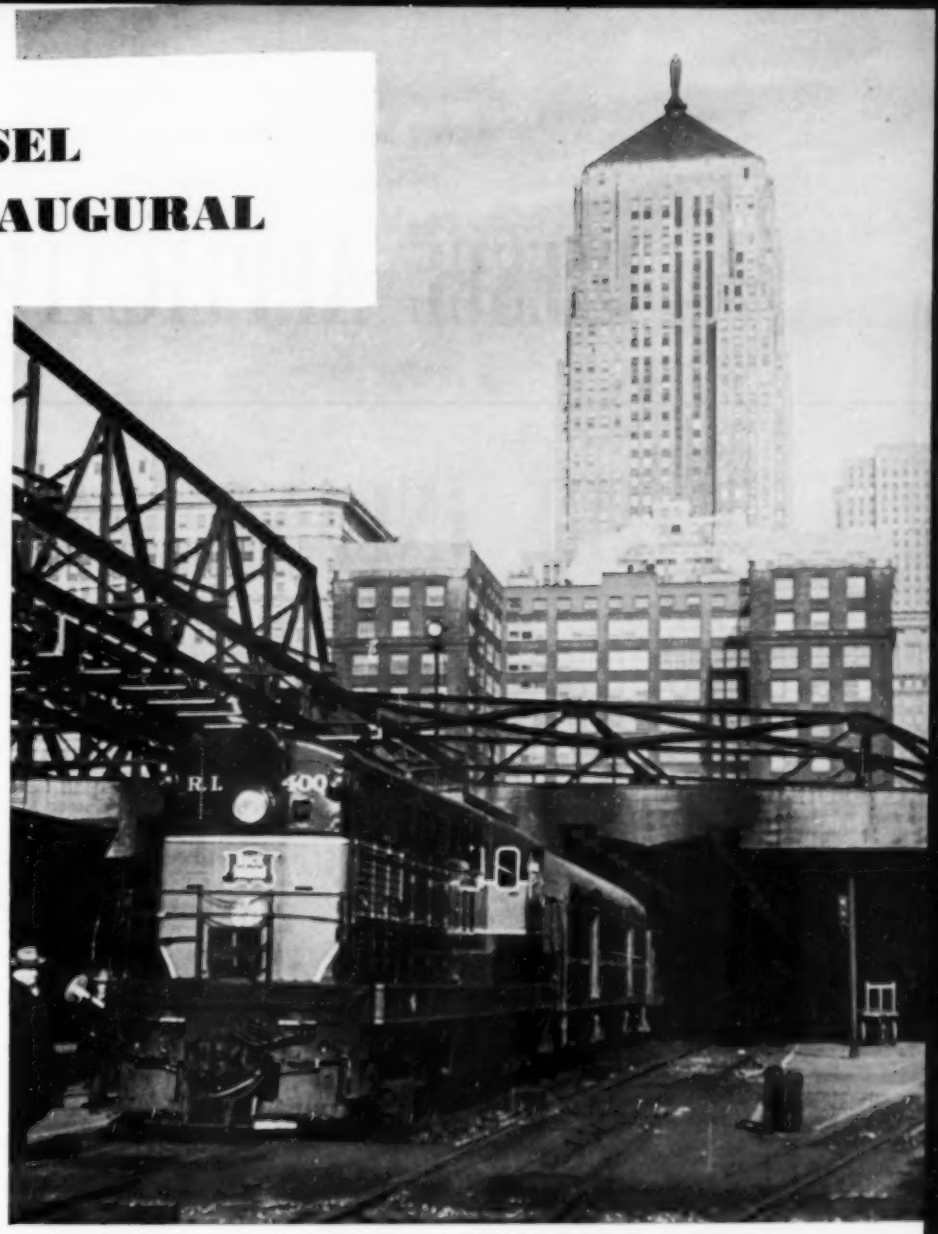
ANOTHER DIESEL COMMUTER INAUGURAL

ROCK ISLAND is another one of the many railroads that have turned to diesel propulsion for its commuter service. This changeover is a part of Rock Island's rehabilitation program for its Chicago suburban service, and has been inaugurated by putting into service two 1500 hp. Fairbanks-Morse diesel locomotives. An additional ten on order with the Electro-Motive Division of General Motors will bring the initial group to twelve.

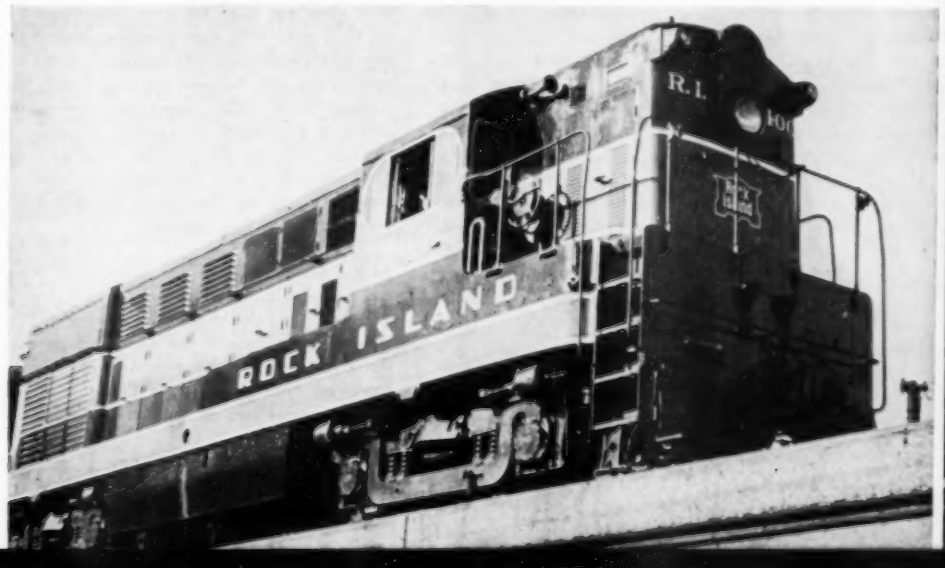
In dieselizing its suburban service, officials on the Rock Island estimate that these two diesel engines, and the ten on order, will replace nineteen of the steam engines now in use. Only eight more diesels will be required completely to dieselize the suburban service which covers 40.2 miles from Chicago's LaSalle St. station to Joliet, Illinois.

Fifty-five trains in either direction serve the Rock Island suburban zone which includes twenty-eight depots at distances between three-tenths of a mile and over six miles apart. With the majority of these stations less than a mile apart, the fast acceleration and deceleration of diesel motive power are looked upon as prime advantages outweighing the comparatively high initial cost of the locomotives. Mr. Farrington, president of Rock Island, declares the diesel locomotive as the answer to replacement of steam locomotives because of their greater availability and the fact that they do not require frequent stops for fuel and water.

Also on Rock Island's new program are twenty new, lightweight suburban cars with a seating capacity for 100 people. Two entrances and exits offer convenience for quick loading and unloading of commuters.



The new Fairbanks-Morse 1500 hp. diesel locomotive, one of two that are in use on the Rock Island railroad.



Diesel engine, used on suburban train in Chicago, pulling Rock Island train bound for Joliet, Ill.

From left: V. H. Peterson, chief of the railroad division, F-M Co.; commuter Lee Mathison; J. D. Farrington, Rock Island president; commuter Fran Hill; Walter Server, engineer.

DIESEL APPLICATION ON

THE INLAND WATERWAYS

WATER transportation is about the oldest form of transport known to man, not only in this country but throughout the world. The explorers, who discovered and laid the ground work, the foundation for the development of this country, traveled by water.

Although this paper is concerned primarily with the use of diesel engines in river transportation it would be well to consider a brief, general review of the development of water transportation.

In the fur trade, which made use of the inland waters from the time of the exploration by La-Salle, in 1682, until well past the first half of the 18th century, we find little that is of more than romantic interest. The traders simply adopted the primitive canoe of the American Indian.

The arrival of the first steamboat on the rivers in 1811 was the beginning of the end for the keelboats. However, between 1810 and 1820, over 3,000 boats per year descended the rivers, and many remained in the coal carrying trade until the time of the Civil War. The pilots of these floating cargoes became the steamboat captains. The first steamboat on the inland rivers was the "New Orleans" which was built at Pittsburgh by Nicholas Roosevelt, who also made the first trip on it to New Orleans.

In 1816 Captain Henry M. Shreve built the steamer "G. Washington," and this boat was the first one designed especially for shallow draft river operation. Up until this time, river steamboat machinery was located in the hull, the same as on sea going and tide water boats; but Captain Shreve built a shallow hull and installed the boilers and engines on the main deck.

The shallow draft steamboats using what was then high pressure steam (up to 130 lbs.), opened a great new territory for water transportation, and as early as 1823 the Great Kanawho River was open to steamers. The Allegheny was navigated by steamer as far as Franklin, Pennsylvania in 1828, and clear up to Olean, New York in 1838. In 1829 the first steamer appeared on the Cumberland River, and the steamboat "Yellowstone" made its way up the Missouri River to the mouth of the Yellowstone. By 1836 steamers had appeared on most of our western rivers.

In the desire for speed, long slender hulls were built. Many speed records established before 1860 have not been equalled to this day. For example, the "Eclipse," built in 1852, had a hull 363 ft. long and a beam of 36 ft., and the "J. M. White" had a hull 250 ft. long by 31 ft. beam. The "J. M. White" set a record from Pittsburgh to Cincinnati (468 miles) of twenty-four hours.

In 1852 the railroads reached Pittsburgh, and this was the beginning of the rapid decline of the packet boats. But following the Civil War, the packet trade boomed again, greater than ever. This boom was due partially to the railroads' inability to handle the heavy flow to freight and traffic. Typical of the post war boats was the "Grand Republic," built in 1867. She was 335 ft. long with a beam of 51 ft. Although no exact figures are available, it has been estimated that by 1850 over 1,000 packets plied the rivers, and that since 1811 over 7,000 packet boats were built.

Also worthy of note is the fact that in 1842 Pittsburgh had more steamboat tonnage than Philadelphia, Baltimore, and Charleston combined, and that the tonnage in all the western rivers exceed that of the entire Atlantic seaboard with that of Great Britain included.

Even while the packet boats were in their heyday, there were rivermen who realize that the logical means of using the river was in the transportation of large bulky cargo. As early as 1832 we hear of barges being lashed to steamboats. In 1854 the steamer "Crescent City" was built expressly for use as a towboat for barges, and by 1870 fleets of barges became a common sight. Because crude oil and coal were found in locations convenient to the rivers, these commodities, then as now, furnished a great portion of the tonnage. Any discussion of river steamboats would not be complete without mention of the sternwheel steamer "Sprague." Built in 1902, and designed to handle large tonnages of coal downstream, this boat was one of the last built for the Pittsburgh to New Orleans coal trade, and probably the most powerful steam towboat ever built on inland rivers. The "Sprague" has become legendary on the rivers, both because she set early records that have never been equalled, and also because, clear into 1948, she was still doing a good job of towing. Now affectionately known as "Big Mama," the "Sprague" in February 1907 took a tow from Louisville to New Orleans, composed of fifty-six coal boats and six barges grossing 70,000 tons.

In 1885 the first Ohio River navigation dam was opened just below Pittsburgh but for many years little more was done for river improvement on the Ohio until 1922, when Congress, spurred perhaps by the traffic jams that resulted from the railroad strikes that followed the first World War, particularly in 1922, passed an appropriation (1924) of $42,000,000 to improve the Ohio. In October, 1929, the chain of fifty-three locks and dams, extending from Pittsburgh to Cairo, was completed, and the Ohio River was assured of a year-round nine foot channel.

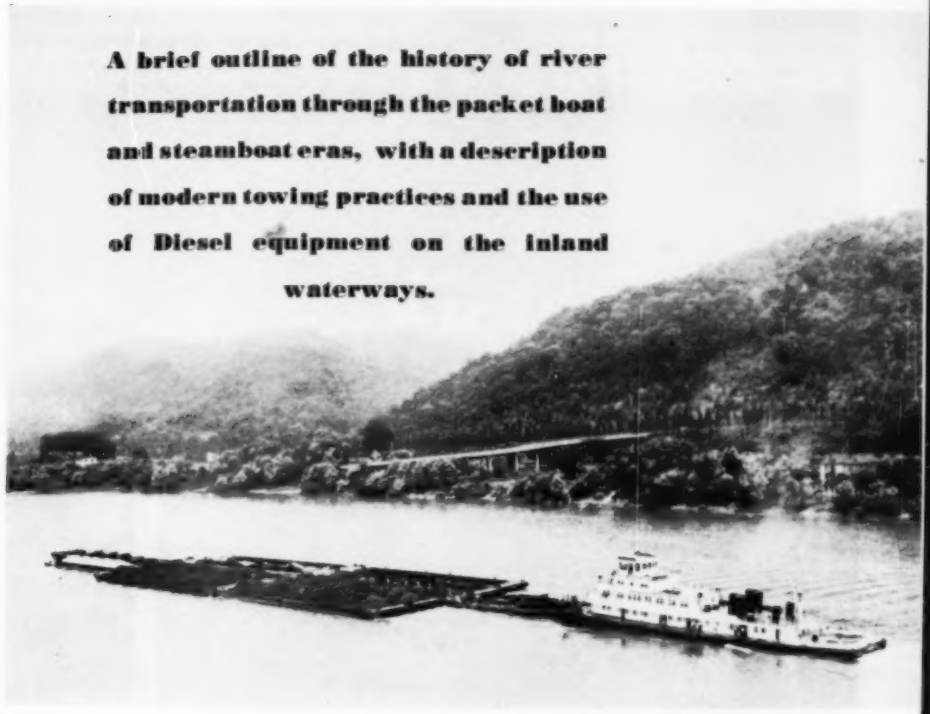
At the present writing, the vast inland Waterway System is 27,900 miles long, greater than the distance around the world. The Mississippi River System, which includes the Ohio and its tributaries, composes a 13,000 mile network of inland waterways furnishing a trade link to the great mid-continental area of America — the heart of

*Ch. Engineer, St. Louis Shipbuilding & Steel Co.
**Owner and Editor of The Waterways Journal.

A brief outline of the history of river transportation through the packet boat and steamboat eras, with a description of modern towing practices and the use of Diesel equipment on the inland waterways.

By ARTHUR R. PARSONS*

CAPT. DONALD T. WRIGHT**



America in which 52% of its population lives, 40% of its products are manufactured, 63% of its mineral products are produced, 56% of all crops, including timber are grown, and 42% of all retail sales are made. Incidentally, water transportation on the Great Lakes is the most efficient in the world, and in 1946 there were transported therein approximately 315 million tons of freight which amounted to nearly 100 billion ton miles.

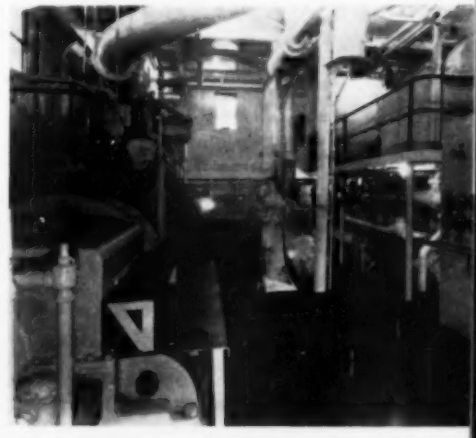
The formation of the Federal Barge Line in 1920 was the start of the modern era in river transportation. The completion of the canalization of the Ohio River in 1929, the opening of the Illinois River to Chicago in 1933, and the completion of the locks and dams on the upper Mississippi, gave impetus to this form of transport. The modern barge is a carefully designed hull, and the size, shape, and capacity together with the service in which it is to operate, are factors which must be given consideration. Extensive tank tests are in many cases made so that the most efficient design is selected for a particular operation. The hulls are of steel and of welded construction, and the efficiency of the modern barges is probably double that of those built 20 years ago. Barges for the transportation of petroleum products have change in design and towing operations in the past ten years. In 1936 began the movement of oil in large volume from Woodriver, Illinois to the Twin Cities, and on the Ohio most oil towing was done above Cairo. The cargo was mostly gasoline piped a short distance from the refineries to the barges and hauled north. With the decline of the Illinois pool, it became necessary to go farther away to obtain the crude, and today a large portion of the petroleum movement is crude oil north from as far as Houston, Texas. Below Cairo and below Alton, Illinois on the Mississippi, the river is different than above these points. There are no locks and dams and the current is faster. Also, on the lower Mississippi, where the river meanders back and forth a great deal, several cuts were made across narrow sections of land which greatly shortened the mileage to be traveled but greatly increased the current in these cuts. This brought about the need for faster tows, and the answer to this was longer rakes on barges, streamlining of the tow, and more power.

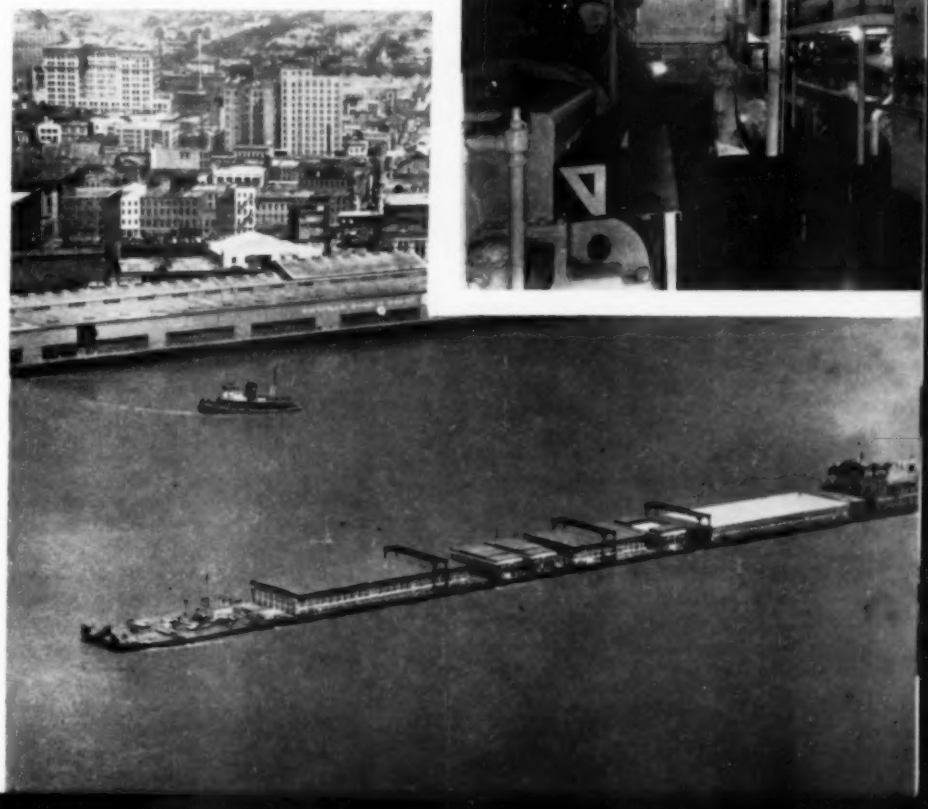
In the upper rivers, above Cairo and Alton where the normal current is less than two miles per hour, a tow carrying as much tonnage as possible for the horsepower available, and making seven to eight miles per hour, is most economical.

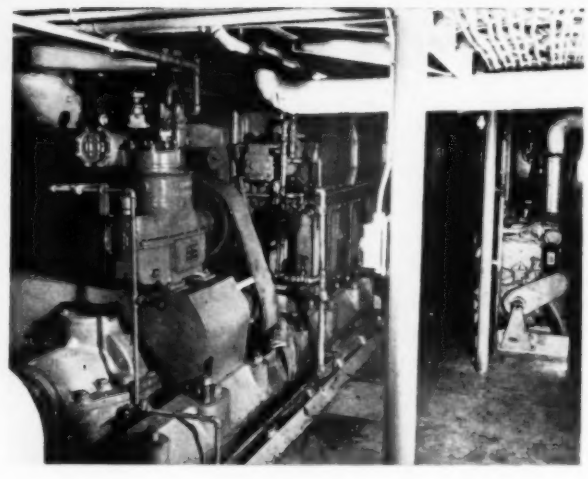
L. Wade Childress, one of the latest towboats to be put in service by the Mississippi Barge Line Company, was built by the Dravo Corporation.

Below, inset, view of port engine of *Harry Truman*. Two 12 cylinder Cleveland diesels give her a lot of push.

Below, official trial of the *Harry Truman* near New Orleans, complete with bow piece and six barges.







Above, *Meriwether Lewis* with two integrated barges of 20,000 barrel capacity. She averages 11 m.p.h. Right, engine room of *Meriwether Lewis* showing 1700 hp. turbo-charged Enterprise diesel. Kingsbury thrust bearing is seen in foreground, engine driven Gardner-Denver compressor mounted above. G.M. 3 cylinder auxiliary diesel at right.

In the lower Mississippi, with an average overall current of four miles per hour, and as high as seven miles per hour in some places, a tow designed to make seven miles per hour is too slow to be economical. We are now designing and building tows to make a minimum of eight miles per hour, and in many cases the tow will make ten miles per hour or more.

Contrary to the opinions of the 1930's, there is today no standard barge or standard tow. Before barges and towboats are built today, tank tests are made of various barge shapes and tow formations to determine the best combination for the conditions to be met on the stretch of the river in which the tow is to operate. These tests have also been made for towboat hulls, because, with the new high-speed tows, the shape of the towboat hull is a factor to be considered.

A few years ago we designed fleets to push six tons per horsepower at five miles per hour. Our latest fleet design will push 6,000 tons at about ten miles per hour, which is about four tons per horsepower at ten miles per hour.

The history of the diesel engine on the river parallels very closely the history of modern river transportation. A semi-diesel boat was built in St. Louis about 1914, and a number of small semi-diesel boats appeared on the rivers in about 1917. The early diesel towboats, as one would imagine, were of the sternwheel type, the builders merely installing the diesels in lieu of a steam engine, and using reduction gears to reduce the engine speed to suit the slow speed of the paddlewheels. The majority of these early diesel boats were of small horsepower, rarely over 1000 horsepower and usually had wooden hulls.

With the river improvements came the need for more horsepower, and with it the need for handling larger tows upstream. The propeller type diesel boats are far superior to sternwheel boats in handling tows going ahead.

The early diesel boats of 100 hp. to 200 hp. were large enough for sand and gravel operators and for towing in canalized rivers; but the horsepower of the diesel boats increased as did the percentage of diesel boats built. The principal reason for this change was lower operating costs and lower initial investment. Also, in many cases, the diesel could be put on a smaller hull.

One of the early propeller type diesel towboats, and the most powerful diesel towboat at that time, was the "North Star," a twin screw towboat built in 1925 with two 240 hp. Fairbanks-Morse diesels. These have since been replaced with engines of more horsepower, and the boat is in active service today. About this same time a number of twin screw towboats were built with horsepowers ranging up to 750 hp.

The term "tunnel type towboat" used in connection with river towboats, denotes one with a tunnel for each propeller. The need for these tunnels is caused by the diameter of the propeller required to absorb the engine horsepower being greater than the draft of the boat. For example, most modern boats are designed for a maximum draft of 7 ft., which means the bottom of the stern is 6'-6" above the baseline to allow six inches of seal; but due to the large horsepower of the engines, it is necessary to use a propeller 7'-6" in diameter. With a clearance of 2 in. above the bottom of the hull, and about 4 in. from the blade tip to the tunnel top, this makes the tunnel 18 in. deep. The boats are not as efficient with tunnels as without, but the effective push is greater as the large diameter wheel is more efficient than a smaller one used with no tunnel.

The river transportation was not expanding very rapidly between 1925 and 1933, and few large diesel boats were built. With the coming of the depression, the need for low cost transportation, and with the completion of the locks and dams, river transportation began to grow and is still growing. Beginning in about 1935, more and larger diesel towboats have been built every year with the exception of the war years when very little river equipment was constructed.

Although good crew accommodations are essential, more important to the operators is improved

boat performance and more power. When the Standard Oil Company of Ohio wanted a 2400 hp. boat, the first large horsepower triple screw towboat was designed and built. This was the "Sohioan," and, with the constant need for more power, in 1946 this towboat was fitted with Kort nozzles to improve propeller efficiency.

At the end of the second world war, with the experience obtained during the war with various types of super charging and other advances in design, the diesel builders were able to deliver more than 800 hp. without increasing the size of the engines. Today towboats are built with 1600 hp. engines on each propeller shaft.

There are a number of single screw and twin screw towboats in operation today using engines of about 1600 hp. at speeds up to 800 rpm. and using reduction gears. The use of reduction gears is a new practice. This was mainly because the gears used before this time were not sufficiently strong to withstand the rugged operating conditions. The earlier gears tried on river towboats would not stand the impact transmitted from a log hitting the propeller, and for this reason were not used until recently when airflex clutches and hydraulic couplings have been used in connection with reduction gears.

One of the most recent towboats built on the rivers, the "Fort Dearborn," is the first river towboat to use the opposed piston type of engines. Rated at 1600 hp. per engine, this twin screw towboat, fitted with Kort nozzles, is one of the most powerful on the river today.

The "Meriwether Lewis" (contract carrier) is 1500 hp. single screw, and is 105 ft. long, 28 ft. wide, and 10 ft. deep. It has a fuel capacity of 135 tons, or an 18 days' fuel supply. It has crew accommodations for 12, and one officers' lounge with the messroom serving as a lounge for the crew. The engine of the "Meriwether Lewis" is directly controlled from the pilot house. When towing three integrated barges, 240' x 50' x 11', with a tonnage of about 8,900 tons, the tow should move a little over nine miles per hour. If only two of the above barges are used with this tow, the tonnage will be 5,700 tons, and the speed about 10½ miles per hour. The above figures illustrate the desirability of the integrated tows, and also show the hp. cost for speed.

We have not mentioned the above type of steamboat using triple expansion engines or uniflow engines. Boats of this type are operating, on the rivers, that were built before the second world war. Among them are the "Ohio" and "Indiana," owned by the Mississippi Valley Barge Line Company, and several other steamboats of this type owned by the Federal Barge Line. It is interesting to note that both of the above companies have had considerable experience with steamboats, and at present both have diesel towboats under construction. Recently the Federal Barge Lines have had two steamboats, the "Helena" and the "Huck Finn," converted from steam to diesel, and are now having the steamer "Kansas City" similarly converted. The last two large sternwheel steamboats were built in 1939 and 1940.

We have considered how river transportation operates. Now let us consider why. Water transportation has always been economical transportation. It has been, and is, the cheapest form of transportation known, and will always continue to be. The benefits of this cheap transportation are not all confined to those located on the banks of navigable waters; such benefits spread themselves many miles from the shore.

The obvious question is, just what are the savings resulting from the use of water transportation on the inland river system? Take bulk sulphur for instance; because there is always a heavy movement of that commodity upon the rivers, sulphur is a most important raw material necessary in the manufacture of many basic products. The all-rail rate on sulphur from Texas to Cincinnati is $12.10 per gross ton. The all-water rate between these points, including terminal charges and delivery to plants, is $6.89 per gross ton, a saving of $5.21 per gross ton of sulphur in favor of the water movement.

The present all-rail rate on pipe from Pittsburgh to Port Arthur, Texas, in the very heart of the oil fields and on the Gulf Intracoastal Waterway—a very important element of our Inland Waterway System, is $15.60 per net ton.

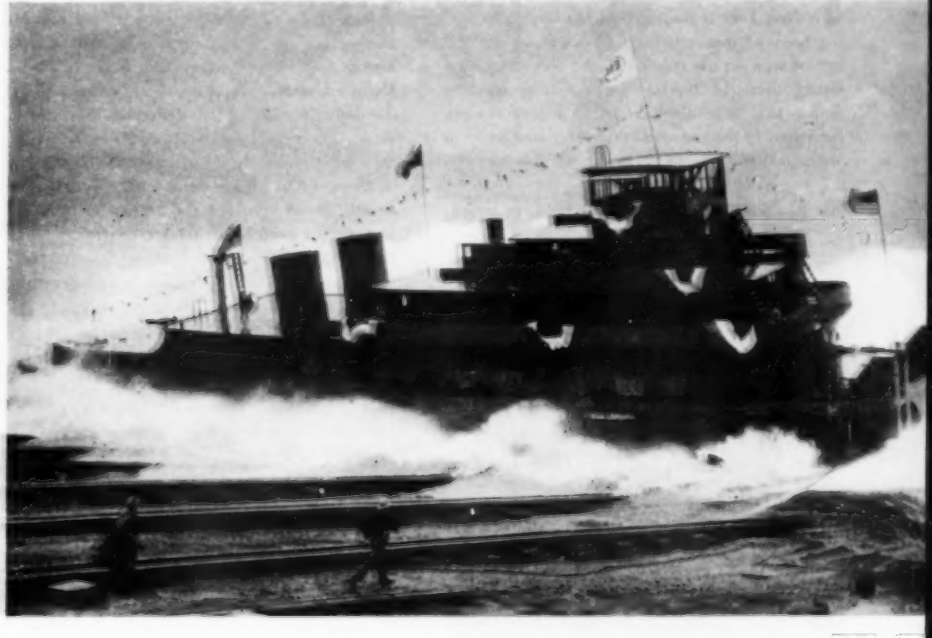
The barge, all-water rate between the same two points, Pittsburgh and Port Arthur, Texas, including terminal and delivery charges, is $.91 a net ton, or a saving of $5.69 a net ton of pipe. Petroleum and petroleum products move over the inland waterway system in ever increasing volume. Hundreds of thousands of barrels of gasoline and other petroleum products, including crude petroleum, are loaded and unloaded on the navigable inland waterways every day of the year. The towboat operators for obvious reasons do not make their operating costs available, but it is generally understood that a diesel towboat can be operated for about two-thirds the costs of a steamboat. This is due to smaller initial investment, a smaller crew requirement, and is also based on the observations at the repair yards, lower maintenance costs.

The figures for 1947 are not available, but there are about 9,500 barges and 1,250 towboats engaged in river transportation today. Of these, 1,250 towboats, 983 are diesel powered, and 267 are steam powered. Of the 267 steamboats, only 23 have been built since 1939. This includes the 21 steamboats built for Defense Plant Corporation during the War when diesel engines were not available.

In addition to a number of towboats being built "on the bank" by their owners, there are under construction, in the shipyards for river use, 22 diesel towboats with a total of over 34,000 hp. The number of barges under construction is hard to obtain, but in our own yard we have orders for 30 with a total capacity of 518,000 barrels.

In 1947 there were 34 diesel towboats built for use on inland rivers with a total of 34,050 hp. The development of the propeller type diesel towboat pushing steel barges is in its infancy. Barely 20 years have passed since the first so-called modern diesel propelled tow was built. Tremendous strides have been made in improvements of design as to machinery, size and shape of tows, and a considerable amount of research, tank tests, and field tests have been made to develop the most economical unit for transportation on Inland Waterways under present conditions with a 9 ft. channel. It is our opinion that the next 20 years will see continued improvement and increasing efficiency in this type of transportation.

Launching of *Esso Louisiana*. This twin screw diesel towboat replaced the *Big Momma*, a steamer famous on the river for many years. Two 1000 hp. Superior diesels power this vessel.



"BANGOR SOCONY"

IN New York harbor, the world's busiest harbor, the Socony-Vacuum house flag is well-known and can be seen on the smallest of the Socony-Vacuum tanker fleet—the *Bangor Socony*. It is hard to realize this little diesel vessel is a tanker when compared to the conventional tanker size, which is about 500 ft. Just 85 ft. long, and able to carry a little more than 500 barrels of product, the *Bangor Socony* is an important member to the tanker fleet. The little tanker's place in Socony-Vacuum's marine transportation picture is to handle bulk lubricating oil deliveries to customers' ships. The delivery service which she renders was developed jointly by the Marine Sales and Marine Transportation Departments back in 1931. The *Bangor Socony* entered this service in May 1932 and she has been on that job ever since.

The Bangor Socony tied up in the North River, New York, to a vessel it is refueling.

The *Bangor Socony* is wooden hulled, has an overall length of 85 feet and a 20.2 foot beam. Her small, or shallow draft of 7.1 feet has proved to be useful in making deliveries on several occasions.

In her eight tanks, she can carry a little more than 500 barrels (approximately 26,000 gallons) of product. Her main power plant is a 6-cylinder, 2-cycle, single-acting General Motors diesel which is designed to develop 200 hp. at 2,000 rpm. However, this engine is regulated for the output of 165 hp. at 1300 rpm., which is sufficient power for the *Bangor Socony* to maintain a speed of 8½ to 9 miles per hour, fully loaded. This power is transmitted to her 42 inch propeller through a hydraulic marine reduction gear and 16 foot tail shaft. Auxiliary equipment includes two diesel engines, one of which is a hand starting Lister-Blackstone 3 hp. at 700 rpm., driving two Blackmer pumps. This unit is fitted with Bosch fuel pumps and a Briggs lube oil clarifier and air cleaner. The other auxiliary diesel unit, slightly larger, is a Fairbanks-Morse engine rated at 20 hp. at 1200 rpm., also directly driving two Blackmer pumps.

Crewman aboard the Bangor Socony throwing a line aboard a vessel it is to refuel in the East River, New York.

The *Bangor Socony* is able to deliver 600 gallons of turbine oil in 15 minutes, or at a rate of 40 gallons per minute. Although she is the smallest tanker to fly the Socony-Vacuum house flag, the *Bangor Socony* is doing, day-in and day-out, a man-sized tanker's job.

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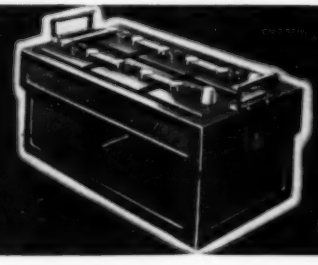
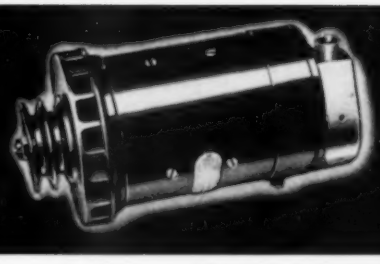




STARTERS
BATTERIES
GENERATORS

TRIPLE-SCREW YACHT "OFFSHORE 64"

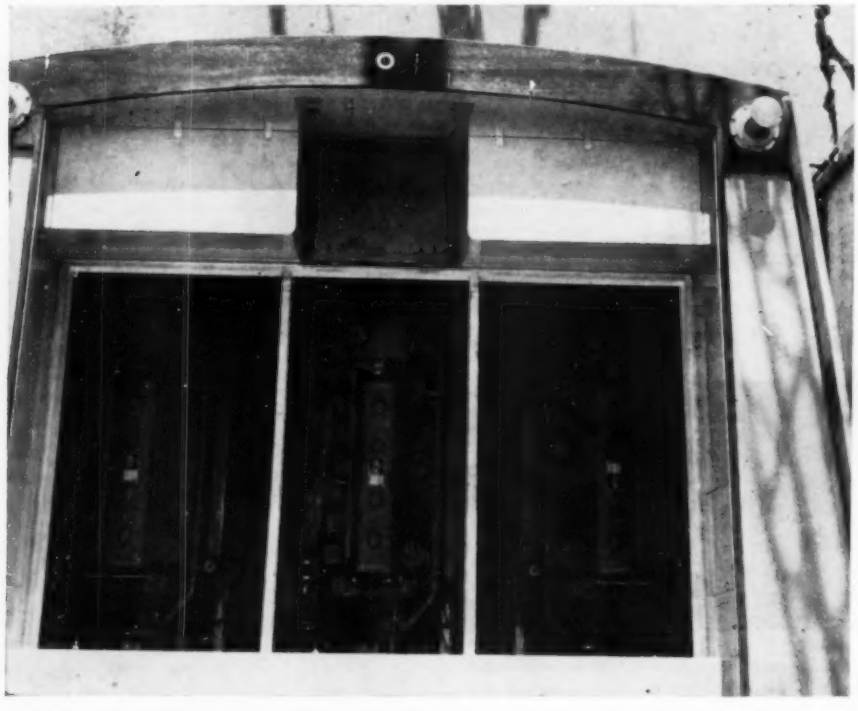
By GEORGE D. CROSSLEY

THE handsome 64 ft. 10 in. triple-screw yacht *Offshore 64* was designed and built in 1948 by the Huckins Yacht Corporation of Jacksonville, Florida, for Mr. Carl Holmes. This yacht, mostly used for cruising in the Bahamas and Caribbean, was superbly worked out to render such lengthy cruises not only pleasant but also safe.

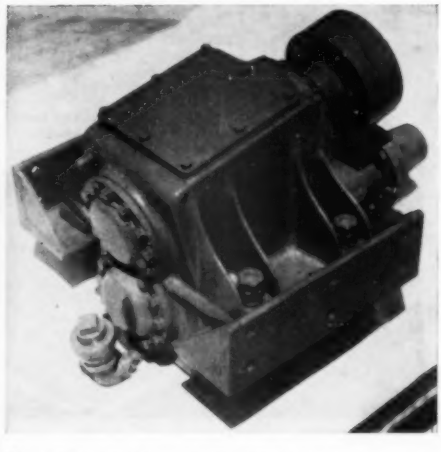
In planning this yacht, several advantages were considered of installing the engines in the stern aside from removing the source of noise to the most distant place in the boat. For example, it permits access to the engines without moving everybody out of the deckhouse. By having an aft cockpit over the engine compartment, it utilizes space that would otherwise be of no particular benefit. It also permits the design of a hull with the center of buoyancy much farther aft, thus obtaining better bow buoyancy. This yacht rises so quickly to a head sea, that it never takes solid water aboard, even in very heavy weather.

The *Offshore 64* is powered with three General Motors Detroit diesels of 200 hp. each at 200 rpm., which has been mentioned above, are located in the extreme stern and drive through the Huckins spiral bevel gear 10 degree Vee Drive. This drive has a reduction of 1.38.

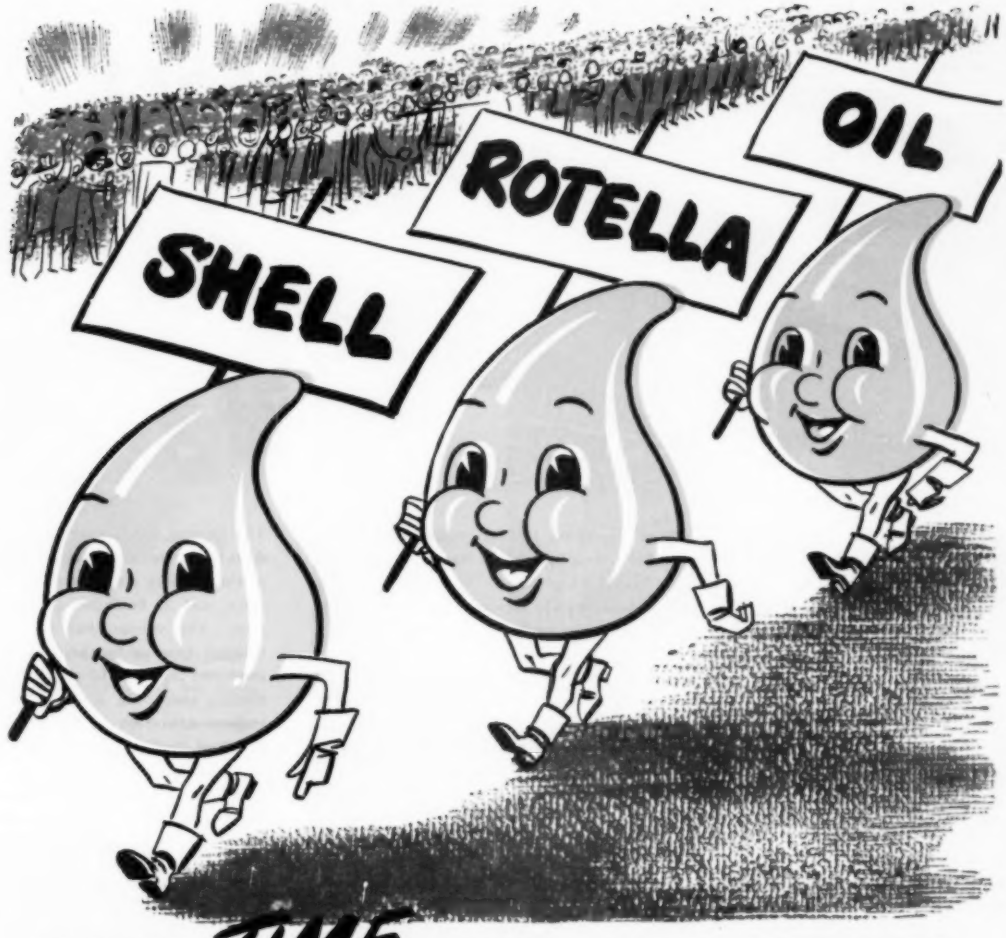
For a yacht of houseboat bulk and accommodations, the 19 knot sustained sea speed is 50% faster than has ever been obtained in such a yacht, irrespective of the kind or amount of power. The overall length is 64 ft. 10 in., breadth 16 ft. 1 in., draft 3 ft. 4 in.



Three G-M diesels with 200 hp. each at 200 rpm., installed in the stern of the yacht.



Huckins 10 degree spiral bevel vee drive gear box with reduction of 1.38.



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The Shell lubrication engineer will give you sound advice about the lubrication of any type of Diesel. For further information, write Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, Calif.

SHELL

SHELL ROTELLA OIL FOR *ALL* DIESELS

AN ALL-DIESEL DAIRY

By ALFRED A. DeCICCO

THE development of modern dairy machinery has been governed by several factors. The general movement for substituting mechanical systems for hand labor and for improving the standard of hygiene has been reinforced by the development of large commercial bodies for the supply of milk and milk products to urban centers and by the increasing range of milk products put upon the market. The results may be seen in the increased mechanization of central dairies and creameries as well as dairying on the farm and the elaboration of methods of transportation.

The Borden Willow Brook Co., of Mt. Vernon, N. Y., one of the most up-to-date dairy companies in Westchester County, which stresses cleanliness and dependable service. Starting from the ground floor we find a complete diesel-generating plant serving the entire power requirements of the dairy. This plant consists of eight diesel engines which supply all power for the plant's pasteurizers, coolers, homogenizers, conveyors, ice machines, bottle washers, bottling machines, and light. In other words, no outside power is purchased. The eight diesels consist of seven Cummins engines and one Fairbanks-Morse. A new Cummins 170 hp. at 720 rpm. diesel has been installed recently to handle the increased load due to additional machinery in the dairy. This new unit drives a Westinghouse 100 kw. generator, exciter, and air compressor, the latter supplying starting air. A Woodward governor is used on this unit. The engine is also equipped with the following auxiliaries: Nugent fuel oil filter, Fram lube oil filter and reclaimer, Ross lube oil cooler, Donaldson intake air filter, Maxim exhaust silencer, Ross heat exchanger, Brown exhaust pyrometer. The six others Cummins diesels are rated at 75 hp. at 1200 rpm. and are equipped with electric starters. A Leece-Neville motor is used for this purpose. Burke 62½ kw. generators are direct connected. Lube oil is filtered by Fram and oil coolers are Harrison. The last diesel unit to be mentioned is a Fairbanks-Morse 185 hp. engine rated at 360 rpm. This rebuilt unit is air started and is fitted with a Woodward governor. The generator is by Electric Machinery Co. having a rating of 100 kw. Lube oil filter and reclaimer is a Hilco.

Complete maintenance of the dairy is done by a staff of fifteen men. Fuel oil consumption is 11 kw. per gallon, with an average cost of 1.3c per kwh. The annual output of the power plant is 263,700 kw., on DC and 678,000 kw. on AC. All heat from the engine exhaust is utilized during the winter for heating process water.

Delivery of milk from the Borden Willow Brook dairy starts at 7:30 in the morning. The routes cover all of Westchester County supplying schools and hospitals plus the private homes. An average of 2400 to 2500 cans of milk a day are produced (10 gal. of milk to a can) and this average is increased during the summer to 3300 per day. As soon as the milk comes in by the first milk truck at 11 or 11:30 in the morning, which is a Mack tractor with tank trailer, driven by a 150 hp. Cummins diesel engine, it is tested by the dairy's laboratory and then directed for immediate production. The milk is always tested before and after bottling, and is not visible until bottled by four o'clock in the afternoon. These diesel trucks carry 3,557 gal. of milk and there are six to eight deliveries a day. The raw milk, direct from the farm, is pasteurized and homogenized at the dairy.

In the method of pasteurization known as the high-temperature, short-time method, which is used at Borden Willow Brook, every particle of milk must be heated to not less than 162°F. for a period of not less than 15 seconds. The equipment used in this system of pasteurization may be divided into two groups, one group using electricity and the other hat water. The hot water equipment is used at the Borden Willow Brook Dairy for their system of pasteurization.

The greatest advantages of the high-temperature, short-time pasteurization, as compared with that of the holding system are 1) the saving of floor space, and 2) flexibility in increasing plant volume. The volume may be increased by larger running time or by the addition of plates. Furthermore, there are no part batches which require holding time. On the other hand, probably the greatest advantage of this system is that it does not lend itself to small plant operation. Plants that can pasteurize their milk with three vat pasteurizers are usually considered to small to use high-temperature, short-time pasteurization economically.

After pasteurization, milk is stored and then conveyed to fillers whereupon the bottles are filled, capped, and sealed automatically. At the end of this operation, they are directed to coolers and await distribution by the morning salesmen. Milk that is put into paper containers is also an automatic operation.

Milk at the Borden Willow Brook Dairy is homogenized in homogenizing machines under 2,000 pounds pressure. The principle underlying the process is the breaking up the fat globules by forcing them at high pressure through minute apertures. The two homogenizing machines at the Borden Willow Brook dairy are driven by two 40 hp. Westinghouse motors, which in turn, rely on the diesel units for energy.

An amazing checking system at the dairy is that if the milk falls below a predetermined temperature, the milk is diverted back to the raw milk tank until proper temperature is obtained. All machines are then started manually. This system is controlled to within a quarter of a degree.

Two 75 hp. Cummins diesel engines drive four ice machines that keep all of the milk in the dairy cold at all times. The chill box in the summer is also driven by these same units.

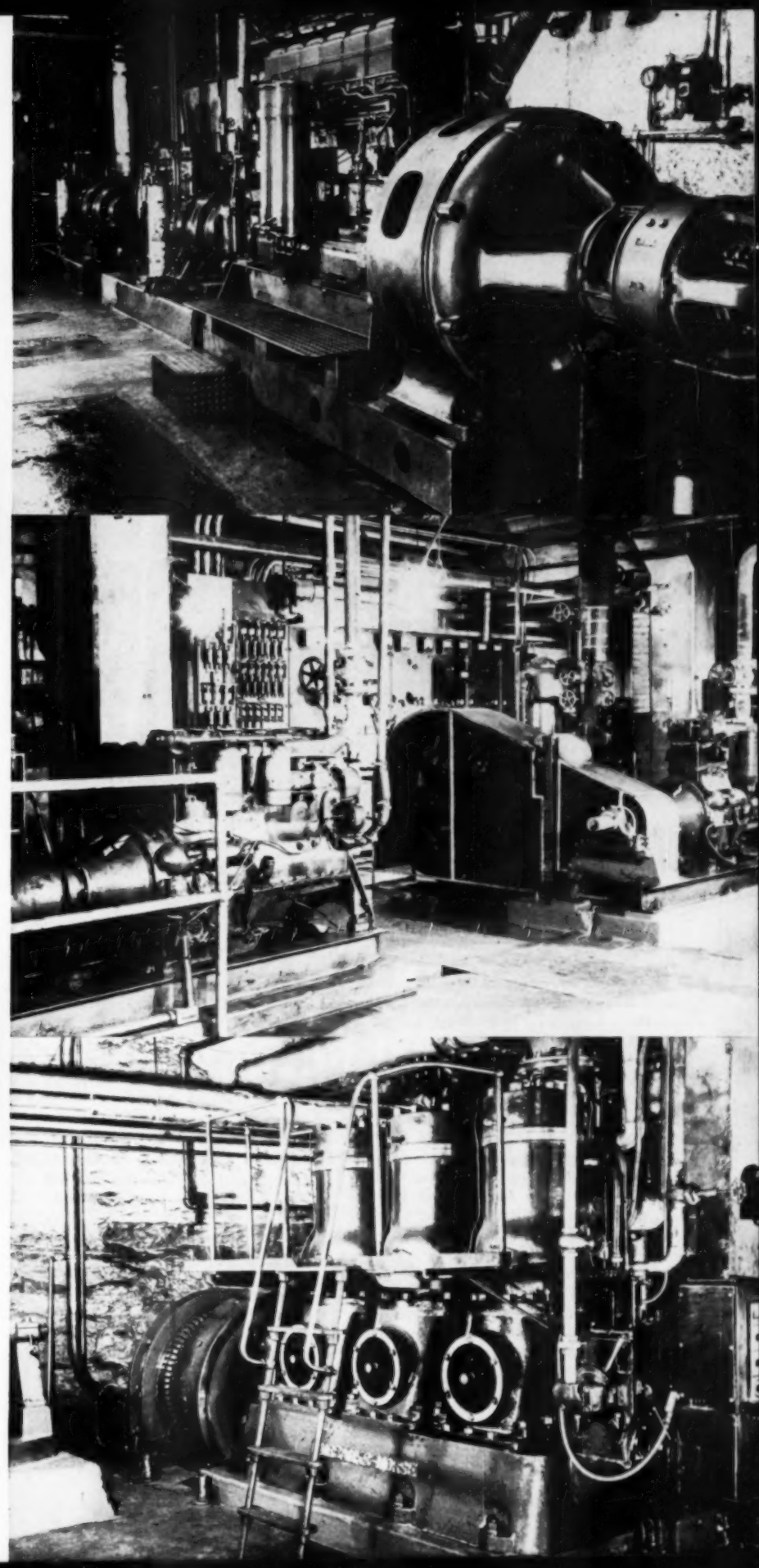
Foreground, Cummins 170 hp. at 720 rpm. diesel unit recently installed. Cummins 75 hp. at 1200 rpm. diesel engines in background.

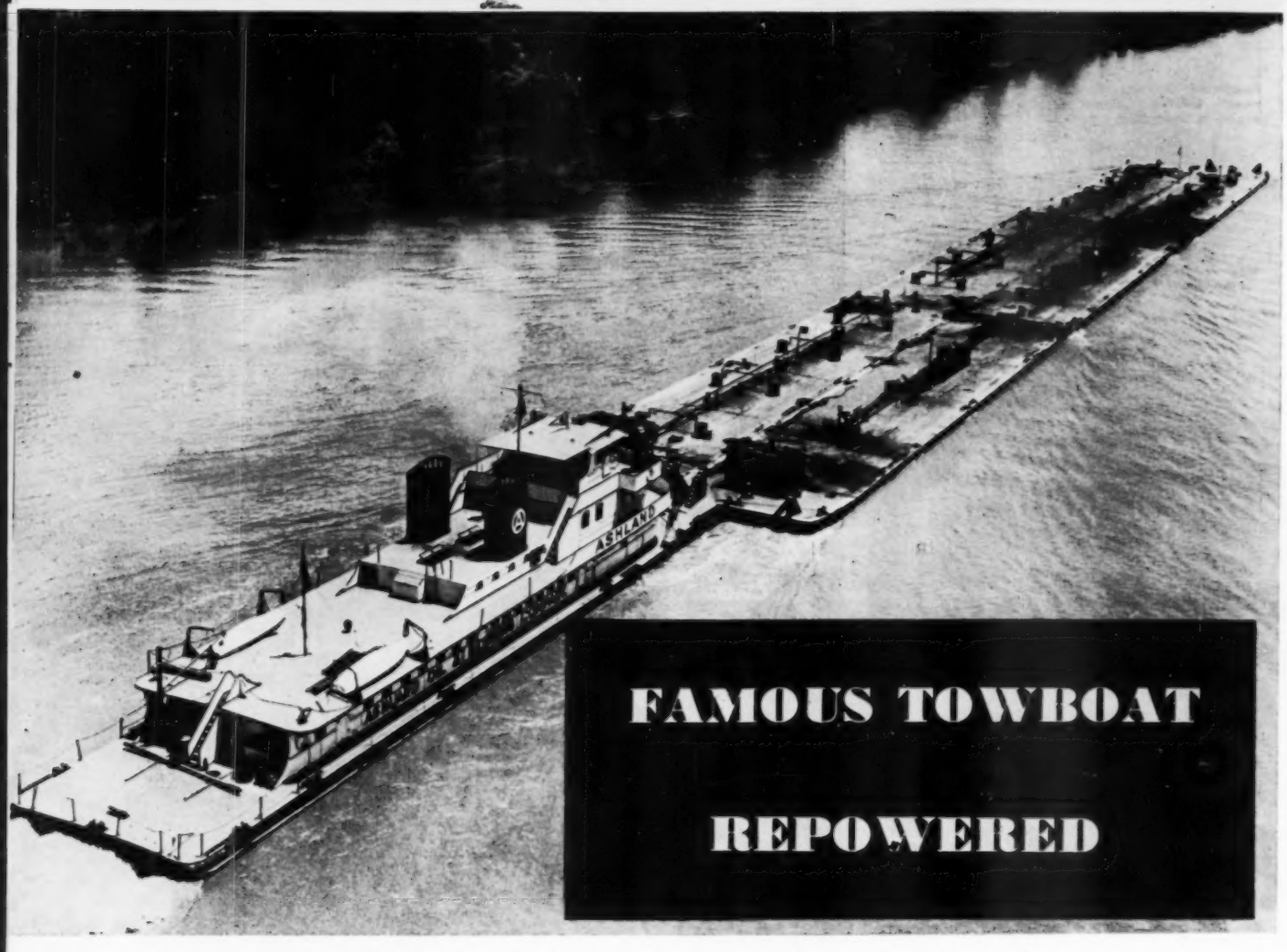
Mack tractor with tank trailer, driven by a Cummins 150 hp. diesel engine, unloading raw milk at the dairy.

Two Cummins 75 hp. diesel engines that supply electric power for four ice machines at the dairy. Same units carry additional refrigeration load of chill box during summer.

Henry E. Swenson, one of the four plant engineers, catching up on some recent information in the diesel industry.

A rebuilt Fairbanks-Morse diesel rated 185 hp. at 360 rpm. and E-M generator powering the dairy's pasteurizers, coolers, homogenizers, and conveyors.





FAMOUS TOWBOAT REPOWERED

The river towboat, Ashland, rebuilt with two new 16-cylinder, 2-cycle, G-M diesel engines, directly connected to an airflex clutch-reverse-reduction gear and rated at 1440 bhp. at 720 rpm.

THAT old equipment can be quickly brought up to date was amply demonstrated recently when the Dravo Corporation of Pittsburgh installed in the Ashland Oil & Refining Company's river towboat, *Ashland*, two new 16-cyl., two-cycle General Motors Model 16-278A diesel engines, each directly connected to a Fawick Airflex clutch-reverse-reduction gear and rated at 1440 bhp. at 720 rpm. New shafting and shaft bearings were also installed. The new engines produce twice the horsepower of the engines they replaced and yet are approximately the same size and only half the weight. Also installed were Kort nozzles, a new rudder, steering gear and propellers.

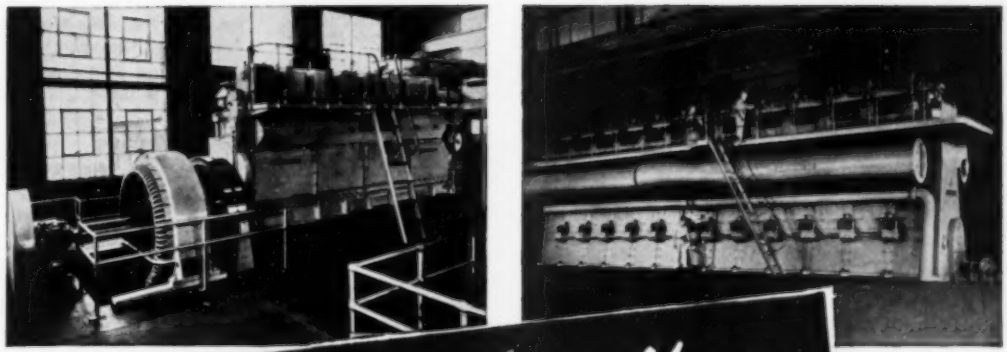
For the first actual test, the *Ashland* was hooked into a fleet of ten coal barges, arranged five abreast and two long to give ultimate water resistance. Then four barges of gravel were added, making fourteen loaded barges in all. Not only did the *Ashland* move them downstream at 6.9 mph., and upstream at 5.08 mph., but did so with an amazingly smooth and quiet characteristic virtually free of all vibration, according to those aboard the river towboat.

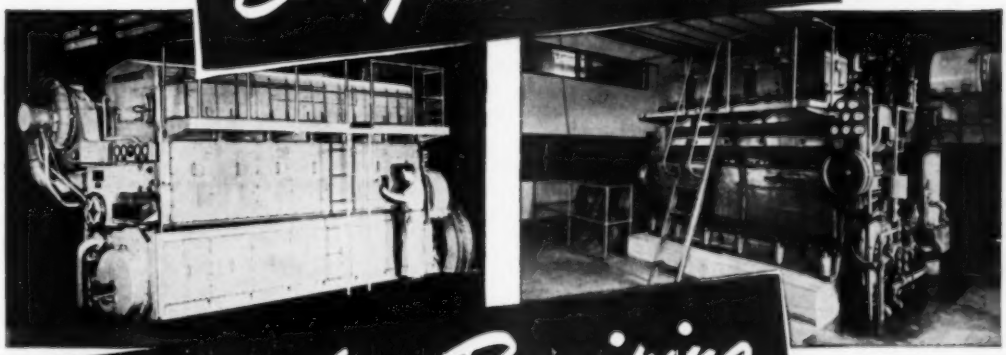
The gauge on the dynamometer barge, which was pushed directly in front of the *Ashland*, showed a thrust of 60,000 lbs. when underway at 5.08 mph. Dock trials, with the vessel moored at the bank, had previously shown a thrust of 88,000 lbs. at 700 rpm., and 105,000 lbs. at 750 rpm. At one point during the trial, the *Ashland* easily turned the tow completely around and, with a minimum of maneuvering, was quickly on its way again. In previous dynamometer tests, at the same point in the river and with similar sized tows, it had been necessary to "jacknife" the tow into sections in order to head back upstream. But the *Ashland* turned its tow within its own length, saving about two hours in maneuvering.

In order to provide steering power for its tow of barges and itself, the rebuilt towboat has two large rudders behind the propellers for use when going ahead, and four flanking rudders forward of the propellers to receive the stream of water from them when backing. Ordinarily, in order to replace a damaged rudder on a Kort-nozzle-equipped vessel, it is necessary to go to drydock. A new method of rudder installation in the *Ashland*, however, permits removing and replacing of rudders without hauling the boat out of the water. A magnetic pilot, designed to hold the boat on a straight course, also is a part of her new equipment. If either the towboat or tow is moved from the course by wind or current, this pilot makes necessary adjustments to bring it back into line.

The Asland Oil & Refining Company operates a fleet of seven modern towboats for bringing crude oil up the Mississippi and Ohio Rivers by barges, loaded at points in Louisiana, Illinois, Indiana and western Kentucky, to its refinery, and distributing the finished products throughout the Ohio Valley.

It also has its own fleet of petroleum barges, and is now building one of the world's largest fleets of semi-integrated barges, which will be 975 ft. long, three bares in width and five in length. It will be handled by the rebuilt *Ashland*, now one of the most powerful towboats on the Mississipp system. Towboat and tow will have an over-all length of 1,126 ft.





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CITIES SERVICE

DIESELS SELL HOUSTON, TEXAS

DIESEL FUEL LOADING SPEEDED ON RAIL SYSTEM

By JOSEPH ALBIN

SPECIAL high speed diesel fuel loading facilities are utilized at Harmon, N. Y., the main shop of the New York Central System for servicing passenger diesel-electrics. The features of the layout are illustrated here, together with details of the positive acting fuel pipe connection on the locomotive.

The fueling plant is located on the south end of the shop, in close proximity with sand and water loading apparatus. At this point each locomotive after being cut off passes through the combined fuel, water and sand loading facility and then moves into the servicing station. It is here that a preliminary inspection is made of the locomotive before its entry in the maintenance part of the shop. At present, approximately thirteen 4000 hp. passenger locomotives pass through this facility each day.

(New York Central procedure at Harmon is to have lubricating oil drained from the crankcase and new oil supplied from centrally controlled pumping stations located on the north end of the shop. Repairing of lubricating equipment is done in this vicinity.)

In Fig. 1 is shown a view of the diesel service track with maintenance shop appearing at far end. In the background to the right is the fuel tank. Fuel pumping equipment is housed in a special building, located near the sand tower. In booths next to the track are control apparatus. Pipes for fuel and for water are kept in long horizontal boxes next to the individual booths. The pumps in the pump house also can be controlled remotely from track points. Fig. 2 shows the interior of the pump house; the filter appears in the foreground.

New York Central utilizes Wheaton fuel connectors on its locomotives. The railroad's maintenance engineers have found this device suitable for high speed flow and for quick disconnect. A quarter turn only is required for closing and to secure a tight fit. The connector satisfies the Fire Underwriters' Code. The parts of the Wheaton connector are shown in Fig. 3.

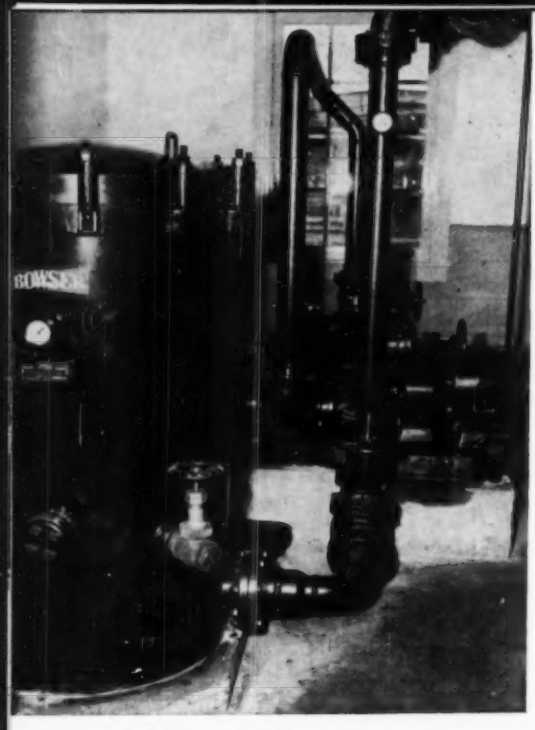


Fig. 2, Pumping unit at the Harmon, N. Y. fuel station.

Fig. 3, Wheaton fuel connectors for the diesel locomotives.

Fig. 1, Service track for the diesel locomotives at Harmon.

DIESELS SELL HOUSTON, TEXAS

THE columns of this magazine sell diesels. And today diesels are "selling" the Port of Houston, Texas. These diesels are propulsion units for the Houston Port Commission's trim yacht the *Sam Houston*, which is used to show off industrial and shipping facilities along the 50-mile Houston ship channel to industrialists, investment bankers, shippers and sometimes a foreign potentate. Houston is not on the Gulf of Mexico, but through its ship channel it has become perhaps the nation's second busiest port.

Because of its raw materials, its shipping facilities and its strategic geographical position (it has New York far outclassed on what some businessmen are calling the Markets of Opportunity, the markets now being developed in South America, Africa and the Orient) new business is flocking to Houston with much of it being located on the banks of the ship channel. But only 50 per cent of the available industrial sites on the channel are being used. It is the aim of the Port Commission to have the other 25 miles packed with factories, too.

That is where the *Sam Houston* comes in to advantage. "The yacht is proving to be well worth its cost," says General William F. Heavey, director of the port and general manager of the public docks (who doubles as Houston's Grover Whalen, welcoming distinguished visitors). "The nearest roads to the channel are about three-quarters of a mile away because the industries require so much area for their operations. The only way you can get a good view is from the water itself. The boat has been instrumental in 'selling' new industries on Houston's advantages."

The Port Commission bought a U. S. Coast Guard cutter hull in Tampa, Florida, in 1948 for $8,000, then had it towed to a Houston shipyard. Where the accoutrements of war had been installed, the Port Commission replaced them with brightly varnished decks fore and aft and a glassed-in, lush-carpeted cabin amidships. The cabin is equipped with leather-upholstered, revolving chairs so visitors may turn to catch any passing sight. The Coast Guard when it operated the boat used gasoline engines. But the Port Commission ordered twin screw General Motors diesels from Stewart & Stevenson Services of Houston.

"My experience with diesels goes back quite a few years," comments General Heavey. "When I was in charge of an amphibious brigade under General MacArthur in 1941, we insisted that landing craft be equipped with diesels. So when we got this hull, diesels were immediately ordered. For one thing, I didn't want to enforce a lot of smoking restrictions on the boat."

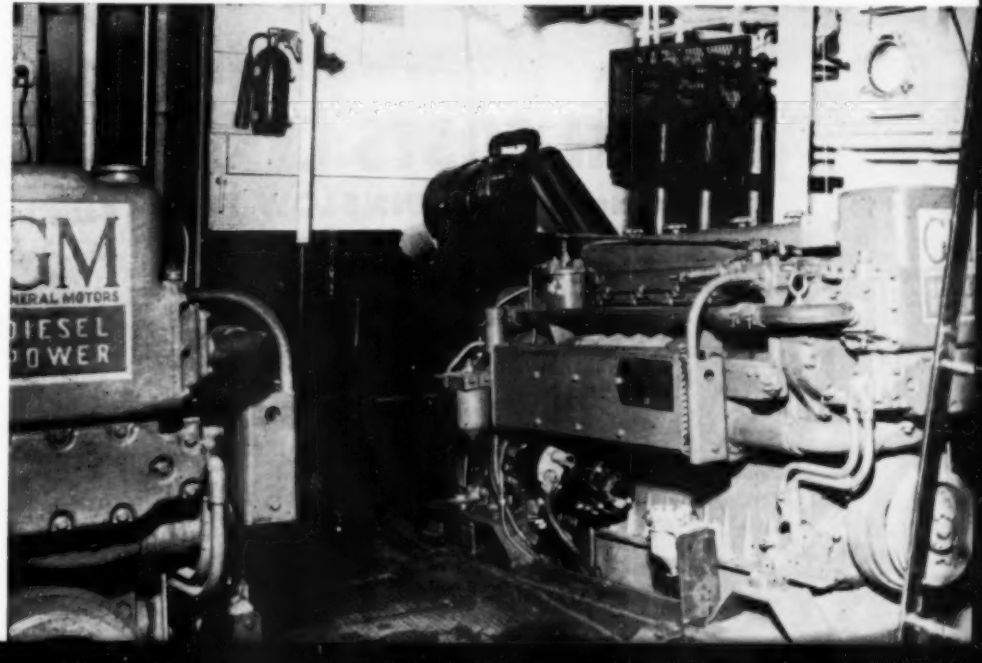
The engine room installation on the *Sam Houston* is one of the most complete you can find anywhere, according to Joe Manning, vice-president and general manager of Stewart & Stevenson Services. A matched pair of General Motors 165 hp. diesel engines provide propulsive power, each turning a separate screw. Each engine is equipped with the new General Motors hydraulic clutch with a two to one reduction ratio. A S.&S. General Motors diesel engine driven auxiliary unit (20 kw.) generates power for electrical facilities. All engines are electrically started. The propulsion engines consume approximately six gallons of fuel an hour each. (Gasoline engines would have required over three times this quantity.) Adel hydraulic Combatrols provide efficient pilot house controls. Just forward of the engine room is a trim galley where coffee and sandwiches are prepared for serving in the cabin above decks. A radio telephone is available for instant communication.

Down the industry-fringed Houston ship channel, the Port Commission's trim yacht *Sam Houston* every few days takes visiting industrialists, investment bankers and government officials on a trip designed to "sell" them on the port's advantages.

When a distinguished visitor arrives in town, he is extended an invitation by General Heavey to take the cruise down the channel on the *Sam Houston*. And when Captain Bob Marshall eases forward his throttles and takes the boat away from the dock, the visitor is in for the most fascinating sightseeing excursion in Houston—down the channel between miles and miles of some of the nation's most vital chemical industries, then a turn at San Jacinto Battlefield, where old General Sam Houston himself had his finest hour. Houston, like his namesake city, won an advantage right near here, too, because he also had boats. He could sail his men and supplies across the rain-swollen rivers while General Santa Anna had to divide his forces to guard his army's crossing of the streams.

Among those who have sailed on the yacht since it was commissioned January 1 are Jose Moreno, consul general of the Philippines, Paul D. Bagwell, president of the United States Junior Chamber of Commerce, Will Clayton, former Undersecretary of State, Joe Maxwell, president of the Burlington lines, many officials of shipping companies and a group of investment bankers from New York and Chicago.

Two 165 hp General Motors diesels, supplied by Stewart & Stevenson Services of Houston, propel the Port Commission's yacht *Sam Houston*.



Leece-Neville Expands

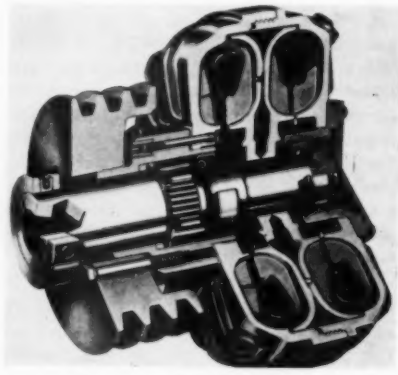
THE Leece-Neville Co., pioneer manufacturer of electrical equipment for the automotive, aviation, marine, and diesel industries, has announced plans for expansion and improvement of its facilities which are expected to greatly enhance production efficiency.

According to S. Floyd Stewart, president, the company's old plant at 5363 Hamilton Ave. has been sold and will be vacated soon, after which the firm's other plant at 5109 Hamilton Ave., purchased during the war, will be the center for both production and administration.

Among Leece-Neville's most recent developments is the rectified AC alternator system which is adaptable to all types of mobile equipment, and which delivers extremely high current output at all engine speeds, thereby practically eliminating storage battery failures.

New Power Transmission Unit

THE Twin Disc Clutch Co. recently announced a new hydraulic power transmission unit — the Hydro-Sheave Drive. The Hydro-Sheave Drive is a hydraulic-conversion device for small electric motors and internal combustion engines which slides directly over the output shaft of any small electric motor or engine.



New hydro-sheave drive.

In the Twin Disc Hydro-Sheave Drive, oil is the only medium of power transmission. Incoming power from the electric motor or internal combustion engine rotates the hydraulic coupling inner member, the blades of which throw a continuous stream of oil against the vanes of the coupling outer member, or housing. The rotation of the housing with its attached sheave or sprocket provides flow of power to the driven equipment. A sudden shock, or overload, from the driven equipment is absorbed by the fluid in the hydraulic coupling and never reaches the motor or engine. Conversely, torsional vibrations from the engine or motor are effectively dampened out by the fluid.

The blades of the Small Hydraulic Coupling are straight and on radial lines, making the coupling reversible. It will transmit torque in either direction and may be installed in either a horizontal or vertical position.

Sleeve bores are machined to fit standard N.E.M.A. (National Electrical Manufacturer's Association) motor shaft sizes. The anti-friction bearings are lubricated for "life." The Hydro-Sheave Drive is entirely self-contained and is supported on its own two bearings—a ball bearing and a needle bearing. This assures proper alignment of all moving parts and alignment of the Hydro-Sheave to the motor or engine.

Mailing Series On Cooling Problems

HOW much do you know about water cooling problems? Here's a chance to score your knowledge. The Marley Company, Inc., manufacturers of cooling towers and spray nozzles, has prepared a series of question-and-answer type monthly mail pieces entitled "What's Your Cooling Tower I.Q.?"

The first of the series deals with water distribution: the second, air movement; the third, facts and figures, and so forth. Although the subject is technical, presentation is informal and attractively illustrated, and makes for enjoyable reading. At the same time, the pieces are informative enough to merit serious study and a place in the permanent files of most engineers. Write the Marley Company, Inc., Kansas City 15, Kansas, if you want to get on the list.

WHICH COSTS LESS

a breakdown or a WINSLOW FILTER?

Guarding costly engines against destructive acids, moisture and abrasives is inexpensive indeed compared to the price one pays for inactive equipment. Your costs are even lower when Winslow engineers protect *all* your fuels and lubricants with *Full-Flo* filtration. Complete information gladly given on request.

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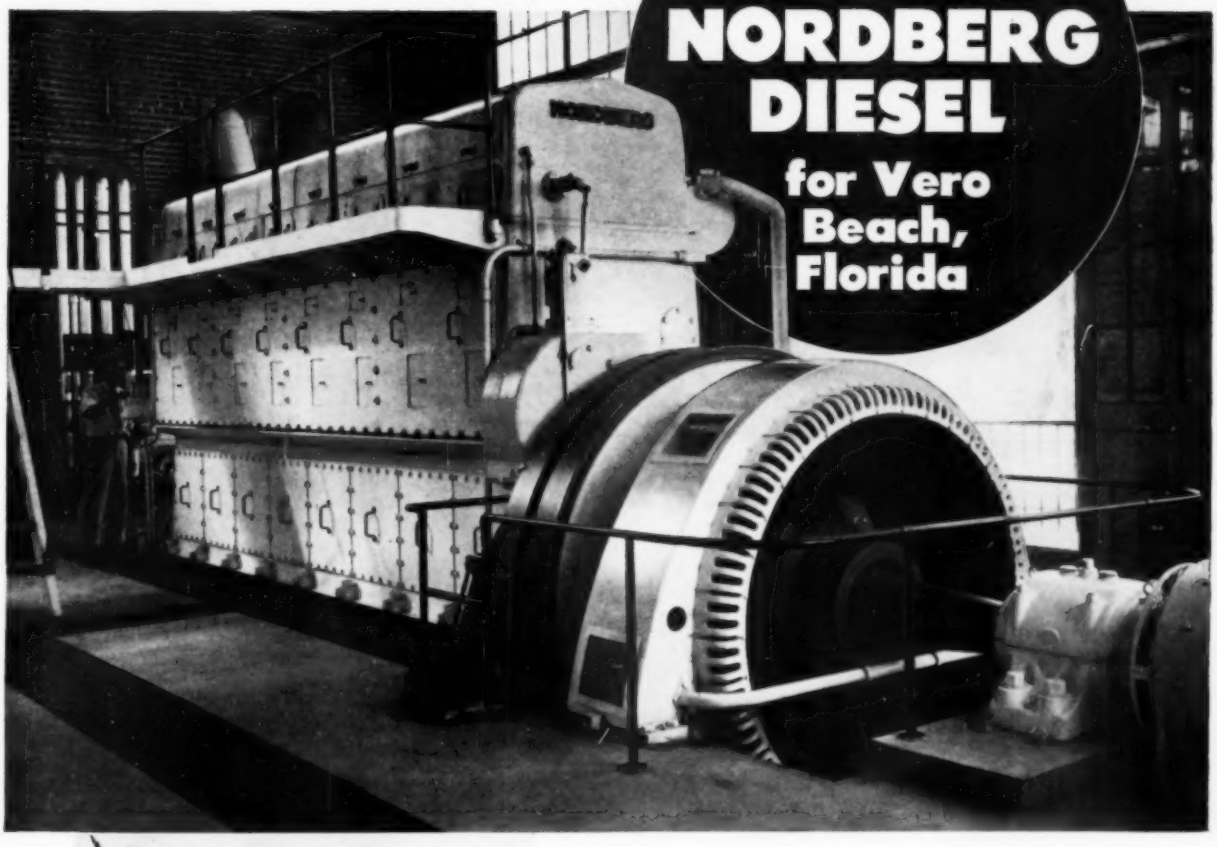
Winslow Engineering Company 4069 Hollis Street • Oakland 8, California

1630 H.P. NORDBERG DIESEL for Vero Beach, Florida



Directly above is an exterior view of the municipal power plant at Vero Beach, Florida.

• • • •

In addition to the 1630 H.P. engine illustrated, Nordberg offers a complete line of stationary power units, in two and four-cycle types, from 10 to 8500 H.P., including Diesel, Gas Diesel and Duafuel models.

Residents of Vero Beach can well be proud of their new spic and span Nordberg Diesel, recently installed to provide dependable electric service for this resort area on Florida's east coast. This new Nordberg is an 8-cylinder, 16″ x 22″ four-cycle supercharged unit driving a 1150 K.W. generator.

It is interesting to note that even though the view shown above was made while the engine was running, there is no camera distortion...added proof that Nordberg Diesels provide smooth, vibrationless power.

If you are considering new or increased power facilities, investigate the outstanding features offered in the complete Nordberg line of Diesel and gas burning engines.

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Precision
BRONZE PARTS
IN ANY QUANTITY
Quality-Controlled Production
Do your specifications call for a simple bushing, a thrust washer or an intricate precision part or shape? We can duplicate it in bronze and in *any* quantity. Unusual research facilities, specialized manufacturing equipment, a Quality Control organization that holds production operations strictly to your requirements, assure precision bronze parts *exactly* as you want them. Research and design service available without obligation. Your inquiry is invited.
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NOW D-X MOTOR OIL CONTAINS EXTRINOL

Yes, now an "extra"—Extrinol—is added to D-X Diesel Motor Oil to bring new lubrication protection to Diesel owners and operators.

Extrinol makes D-X Diesel Motor Oil stand up longer and lubricate better. It helps clean engines. It protects bearings. And it fights dangerous sludge formation.

If you want real Diesel economy, change to the new D-X with Extrinol. And, if you're not satisfied that it is a better, less expensive Diesel motor oil to use, your money will be refunded on the famous D-X Money-Back Guarantee. Ask your friendly D-X Dealer for details about this great new Diesel oil.

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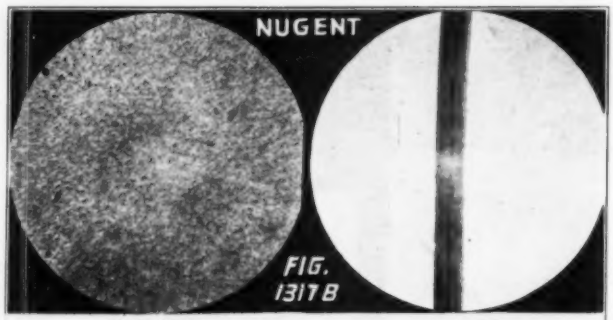
Can your filters match this cleaning power?



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ABSORBENT OIL FILTERS
GET 99.8% OF THE DIRT!

The "before and after" photomicrograph reproduced above is positive proof of the ability of Nugent Filters to keep dirt out of the vital working parts of your equipment. And just to give you an idea of the magnification in this view, the dark line running vertically through the "after" picture is a human hair (.0025" dia.)!

Carefully controlled tests under operating conditions show that Nugent Absorbent Filters will get 99.8% of the dirt! Translated into benefits for you this means longer life and less maintenance for your equipment and substantial savings in oil.

There is a Nugent Filter of the proper size and type to meet your requirements. Write today for complete data.

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CHROME plated rings are the newest addition to Perfect Circle Corporation's line of piston rings and associated products. These rings are top groove compression rings.

Perfect Circle's chrome rings were developed, produced, and successfully used during World War II in airplane and tank engines. Continued postwar research and improved methods of manufacture have resulted in enough additional production to enable Perfect Circle to offer this ring to the replacement market.

Dix Universal Joints

Dix Universal Joint

HOW today's ultra-achievements in precision manufacture with quality alloys vastly increase service life, dependability and satisfaction, can be noted in Dix Precision-Built Universal Joints, manufactured by Lovejoy Flexible Coupling Co.

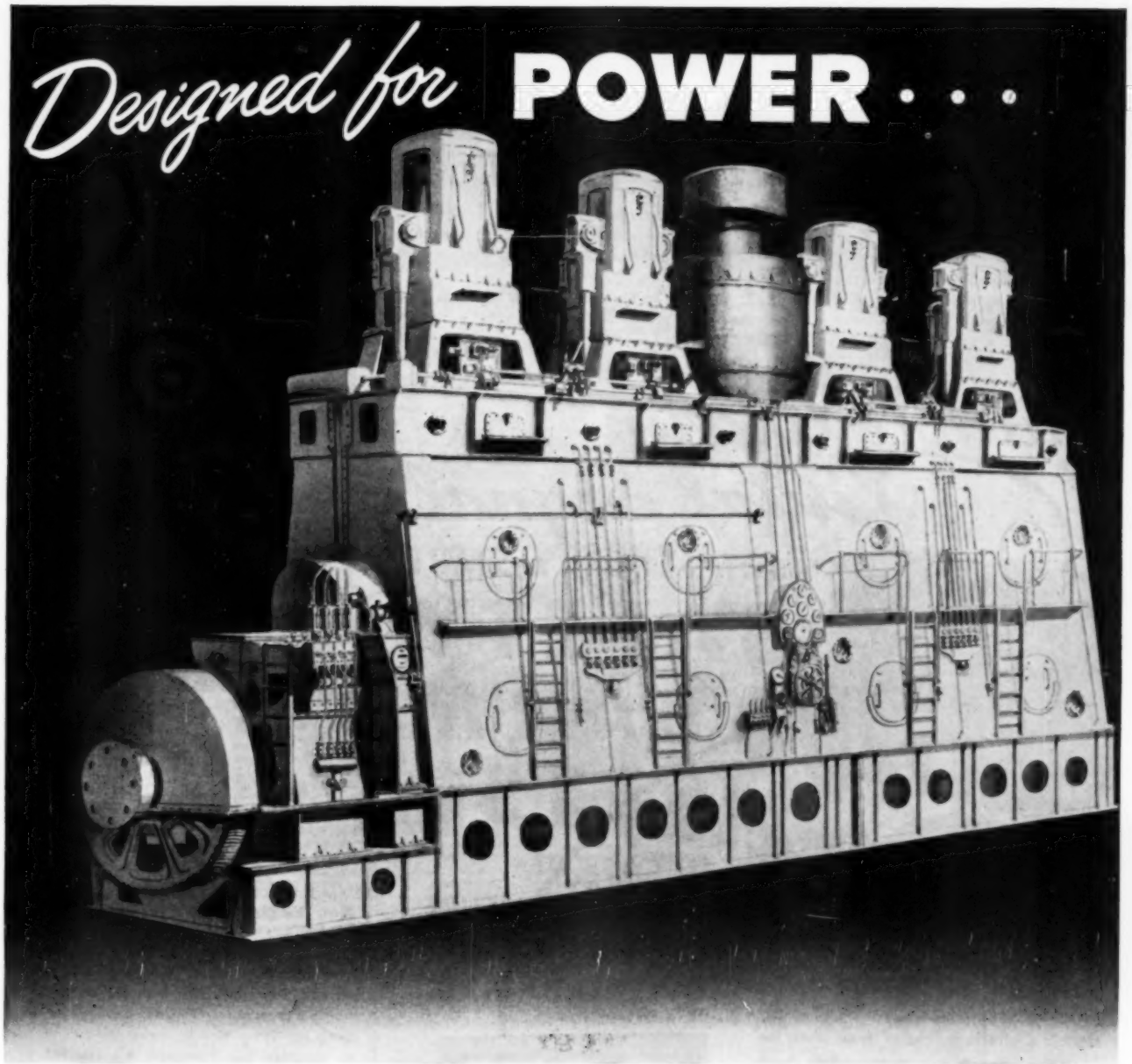
Dix Joints are concentric within .0005. Equipment produced by Dix engineers finishes grinding inside forks and bearing surfaces of center blocks, all operating surfaces so that pins cannot bind, backlash nor inplay. All rivets are ground flush with the body of the joint to permit working inside tubing, or in closest quarters. Dix Joints come in fourteen sizes from 3/8" to 4" hub diameter, or to user's requirements.

Schryver Appointed Divisional Superintendent of G-E's Locomotive Manufacturing Division

WILLIAM F. SCHRYVER has been appointed superintendent of General Electric's Locomotive Manufacturing Division according to G. W. Wilson, Manager of the Locomotive and Car Equipment Divisions.

Mr. Schryver transferred to the Locomotive and Car Equipment Control Division in 1945 as assistant superintendent. He became superintendent in 1946 and remained in that position until his present promotion.

Designed for **POWER . . .**



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2 Cycle Opposed-Piston DIESEL ENGINES

For dependable marine installations. Furnished in sizes from 1,000 to 10,000 S.H.P. Facilities available for repairs to all types of marine propulsion.

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SHIPBUILDING & DRY DOCK COMPANY

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Metallizing Crankshafts

THE March issue of Metco News, a house organ of the Metallizing Engineering Co., Inc., is packed full of facts on rebuilding worn mains and throws on crankshafts. To the owners of automotive and industrial engines, gas or diesel, air and ammonia compressors, metallizing offers a number of advantages over the old method of grinding worn mains and throws and refitting with undersize bearings.

Different types of crank and cam shaft bearing surfaces can be reclaimed by being built up with high carbon steel or stainless steel and the sprayed sections finished by grinding.

Hemphill Schools Changes Hands

HEMPHILL Diesel & Automotive Schools, America's pioneer school in diesel instruction, has been acquired by West Coast University, Los Angeles. The Hemphill organization will become a department of West Coast University, a state-chartered school, and will provide diesel instruction and training on the following three levels.

1. Diesel engineering as an option under the University nine-semester course leading to a degree of Bachelor of Science in Mechanical Engineering.

2. An intensive four-month course in Diesel Mechanics for resident students.

3. A one-year Home Study course for up-grading diesel industry personnel, or as preparation for worth-while employment in the industry.

West Coast University is one of the pioneer educational institutes to offer instruction on the technical and trade level, in addition to its concentrated program of courses in Mechanical and Electrical Engineering. All phases of industry are cooperating wholeheartedly with the University in furthering this new concept of education.

The Old and The New

ONE of the most modern units of railroad motive power, a 70-ton American Locomotive–General Electric diesel-electric switching locomotive, passes through a remembrance of the past, an old wooden-covered bridge on the St. Johnsbury and Lamoille County Railroad. This Vermont railroad has five of these picturesque bridges still giving good service on the line.

The St. J. & L. C. has almost completed diesel-electrification with the acquisition of four of these Alco-GE 70-toaners. One more is scheduled for shipment in the near future.

New Engineering Works at Rotterdam

AT ROTTERDAM the foundation stone has been laid for a marine diesel engine works and erecting shop which are built for an enterprise which was set up at Henglo (province of Overijssel) in 1946. Already during the two years of its existence this enterprise has received both Dutch and foreign orders for equipping 26 vessels with diesel engines with a total output of well over 50,000 hp. The diesel-motor installations for 12 vessels have already been delivered.

It is hoped that the works-hall will be ready by the middle of 1949. Plans for further extension are in course of preparation.

Bristol Publishes Diesel Engine Pyrometer Bulletin

A NEW bulletin on Bristol Diesel Engine Pyrometers has just been published by The Bristol Company, Waterbury 91, Conn. Approved Navy and commercial type diesel engine pyrometers and thermocouples suitable for use on all types of diesel engines are described and illustrated with photographs and dimensioned drawings. Twelve-page Bulletin P1239 is available from The Bristol Company on request.

Audible Alarm PLUS A Visual Signal WITH SYNCHRO-START SAFETY ALARM SETS

A dependable safety alarm set at a price well within the budget of every engine owner. One failure will more than repay the cost of the control in the saving of repair bills and loss of service.

Provides a visual signal combined with an audible alarm for any number of safety signals desired; a light to show when the control is operative; a test switch to check all failure circuits simultaneously, and an alarm silencing button with automatic reset. These sets also can be furnished with a shutdown circuit to stop the engine before damage can occur if the trouble is not corrected soon enough.

Write for the new Synchro-Start catalog fully describing these Alarm Sets and our complete line of automatic engine controls.

IN CASE OF—
LOW OIL PRESSURE
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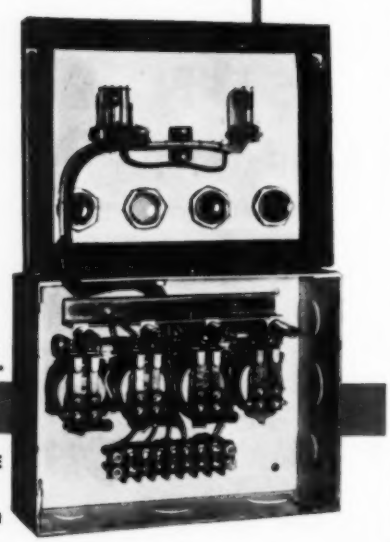

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Automatic Engine Control Equipment
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go 18 months between overhauls with
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ROMANCE, RESCUE and 'BLACK GOLD'
GULF OIL TANKERS COMBINE ALL IN A DAY'S WORK!
ON THE TROPICS AT PUERTO LA CRUZ, VENEZUELA, THE GIANT TANKER, GULFPRIDE, LOADS HER PRECIOUS CARGO OF "BLACK GOLD" FOR THE REFINERY IN PHILADELPHIA, 2300 MILES AWAY.
THREE DAYS OUT AND PLOWING NORTH WITH 6½ MILLION GALLONS OF OIL IN HER TANKS, THE TANKER PICKS UP A FRANTIC S.O.S., CHANGES COURSE AND FULL SPEED AHEAD.
HARD RIGHT RUDDER, SLOW AHEAD. STAND BY TO LOWER STARBOARD LIFE BOATS
HER 2500 H.P. DIESEL ENGINES WORKING AT PEAK POWER PUSH THE 20,000 TON SHIP AT TOP SPEED. THE SURVIVORS ARE SIGHTED!
A LIFE BOAT IS SENT OVER, AND A DANGEROUS SEA RESCUE IS EFFECTED. GRATEFUL SURVIVORS ARE GIVEN HOT DRINKS AND MEDICAL ATTENTION...AND THE GREAT TANKER IS ON HER WAY AGAIN, NO TIME FOR PLAUDITS.
DESPITE TIME TAKEN IN THE RESCUE, SHIP ARRIVES ON TIME AND HER DIESEL-DRIVEN PUMPS DISCHARGE THE OIL AT THE RATE OF 200,000 GALLONS AN HOUR.
THE GULFPRIDE'S CHIEF ENGINEER SAYS:
OUR SCHEDULES DEMAND CONTINUOUS ROUND TRIPS FROM THE TROPICS TO THE NORTH WITH 18 MONTHS BETWEEN OVERHAULS. THAT'S WHY WE SPECIFY KOPPERS PISTON RINGS IN ALL OUR DIESELS

KOPPERS PISTON RINGS have won their reputation the hard way . . . in the tough service of ocean-going tankers and tugs, high-speed streamliners, overloaded pumping engines.

Where dependability and economy are essential, you'll find engine builders and operators specifying Koppers American Hammered Rings. The reason for their superlative performance is simple. They embody the two greatest developments in piston rings . . . Porous Chrome* and K-Spun.

Take a look at the important features listed at the right. Then take a step toward longer ring life and better service. Check with Koppers engineers now. Koppers Company, Inc., Piston Ring Dept., Box 626, Baltimore 3, Maryland.

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1. Guaranteed against ring breakage. Tensile strength double ordinary gray iron castings.
2. All rings seat immediately without scuffing and scoring.
3. Ring and cylinder wear greatly reduced.
4. Fifty percent more elasticity retains shape and tension far longer.
5. Four times greater impact strength means long life in severe service.

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Petroleum Issue of Production Road

THE interesting story of the production of oil—from the first survey to the refined product—is told in the Petroleum Issue of Production Road, magazine of the Twin Disc Clutch Company, Racine, Wisconsin. Just off the press, this 28-page pictorial review of the oil industry contains sections devoted to the exploration, drilling, pumping, piping and refining of oil. Profusely illustrated with action photographs of Twin Disc equipped machinery, it tells the complete story of oil and the part played by Twin Disc Clutches and Hydraulic Drives in its production. Copies of the Petroleum Issue of Production Road may be obtained from any one of the Twin Disc Branch Offices, Authorized Repair Parts Stations, or by writing directly to the Twin Disc Clutch Company, Racine, Wisconsin.

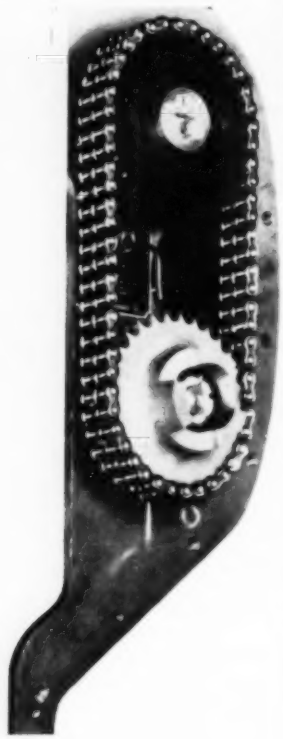
Air-Maze Appoints Minor Dow

AIR-MAZE Corporation recently announced the appointment of Mr. Minor Dow as factory representative for the State of Michigan. Mr. Dow replaces Mr. Harry W. Lutz, who has been with the company for many years and is now changing locations. Mr. Dow will be located at 412 Curtis Building, Detroit 2, Michigan.

FOR GREATER SIMPLICITY USE

Diamond Roller Chain For Lube Oil Pump Operation—

- Positive
- Easy to Install
- Noise-Free



Distance between shafts means nothing to a chain drive. Space required can be kept to a minimum—load is distributed over many sprocket teeth—there is no slippage—and long service has no effect on the efficiency.

Diamond Roller Chains are used by a host of foremost engine builders—Diamond has developed the engineering technique and the special precision manufacturing facilities to insure the uniformity of quality and reserve strength required for long-life performance. Practical engineering assistance and a copy of Diesel Drive Booklet are yours for the asking.

The Trade Mark on Diamond Roller Chains since 1890

DIAMOND CHAIN COMPANY, Inc.,
Dept. 407, 402 Kentucky Avenue, Indianapolis 7, Ind.
Offices and Distributors in All Principal Cities.

DIAMOND ROLLER CHAINS

Willard R. Cotton

WHILE on a business trip, Willard R. Cotton of Chicago passed away in the Hotel Schroeder, Milwaukee, April 7. Having had a long career as a publication representative in the Automotive and Diesel fields, and possessed of a magnetic personality, he acquired a host of friends who will mutually share a sense of loss at his passing. Mr. Cotton was 56 and had served with Automotive News for 17 years when he joined DIESEL PROGRESS and the Palmer Publications in September 1942. In 1948 he formed the firm of Jones and Cotton, magazine representatives. He is survived by his widow, Hazel.

Synchro-Start Issues New Catalog

A NEW catalog No. 4, made up as a very attractive loose-leaf binder and containing a series of bulletins covering its complete line of automatic controls, has just been issued by Synchro-Start Products, Inc. There are thirteen bulletins in the series covering the range of products which include full automatic control sets, automatic starting control sets, power failure starting—manual stop, automatic cranking controls, automatic temperature starting control system, safety stop and alarm, safety stop controls, overspeed governors, solenoids and heavy duty starting motor contactors, relays, auxiliary engine controls and multiple engine control panels. Each bulletin is a complete presentation of the equipment which it covers and includes wiring diagrams and installation illustrations. The bulletins are bound in a snap-ring binder conveniently arranged for replacing the sheets as changes are made. The whole represents a complete and attractive catalog which design engineers and operating personnel would find most useful. Synchro-Start Products, Inc., 1046 West Fullerton Ave., Chicago 14, Illinois, will be glad to mail a copy of this valuable catalog upon request.

Director of Sales for Drake America

Dennis E. Tiberiis

DENNIS E. Tiberiis has been appointed to the position of Director of Sales for Drake America Corporation, New York. He will supervise the activity of the export and import divisions of Drake America, as well as the Hill Diesel Engine Division, which handles both domestic (United States) and export sales of Hill Diesel Equipment.

Mr. Tiberiis joined Drake America in March 1947 as Export Manager. He formerly was export manager of the Sales Division of Frazar & Company, and before that was in charge of export for The Diamond Match Company.

50 YEARS of growth and development . . .

A half century ago the diesel industry was born . . . born to become an important factor in today's economy. From an infant, it has survived its "growing pains" and has developed into a Giant whose strength can be utilized in a myriad of important tasks. Erie Forge has been a part of this growth . . . developing better cranks and connecting rods to more capably serve the users of diesel engines.

Consult with us on your problems.

ERIE FORGE COMPANY, ERIE, PA.

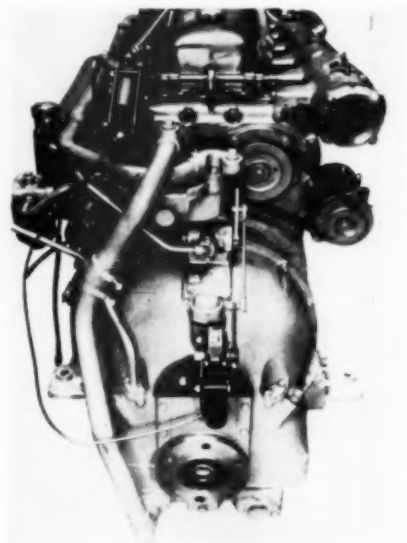
New Parts Depot

A new parts depot, established by Caterpillar Tractor co., to facilitate parts shipments to "Caterpillar" Dealers and customers is under construction in Indianapolis, Indiana, and will be ready for occupancy this summer. The depot, stocking parts for "Caterpillar" Diesel track-type and wheel-type Tractors, Diesel Engines, Diesel Motor Graders and earthmoving equipment, will permit strong support of Dealers' parts inventories and speedy handling of emergency parts requirements of customers. Construction has already started on the $150,000 structure, situated at the corner of Howard and Harding streets in Indianapolis.

The Indianapolis depot will serve "Caterpillar" Distributors in Indiana, Illinois, Wisconsin, Michigan, Iowa, Missouri, Kentucky, Ohio, Tennessee, Pennsylvania, West Virginia, Virginia and Maryland in addition to Ontario and Quebec, Canada. Other Caterpillar Tractor Co. parts depots are situated in Spokane, Washington; San Leandro, California; Minneapolis, Minnesota; Kansas City, Kansas; Shreveport, Louisiana; Albany, New York; and Atlanta, Georgia.

Hydraulic Control Mounting Kit

COMPLETE kits for convenient mounting of Sperry hydraulic remote controls on General Motors series 71 diesel marine engines has been announced recently by Sperry Products, Inc. The kits include all parts needed for attaching Sperry Type F controls to both throttle and hydraulic clutch of General Motors marine diesel engines.



Sperry controls on GM marine diesel

The single-line Sperry hydraulic control system is easily mounted in working and pleasure boats, with a line as long as 100 feet separating the transmitter and receiver units. Intermediate control stations on deck, flying bridge, or engine room can be provided with accessory intermediate transmitters.

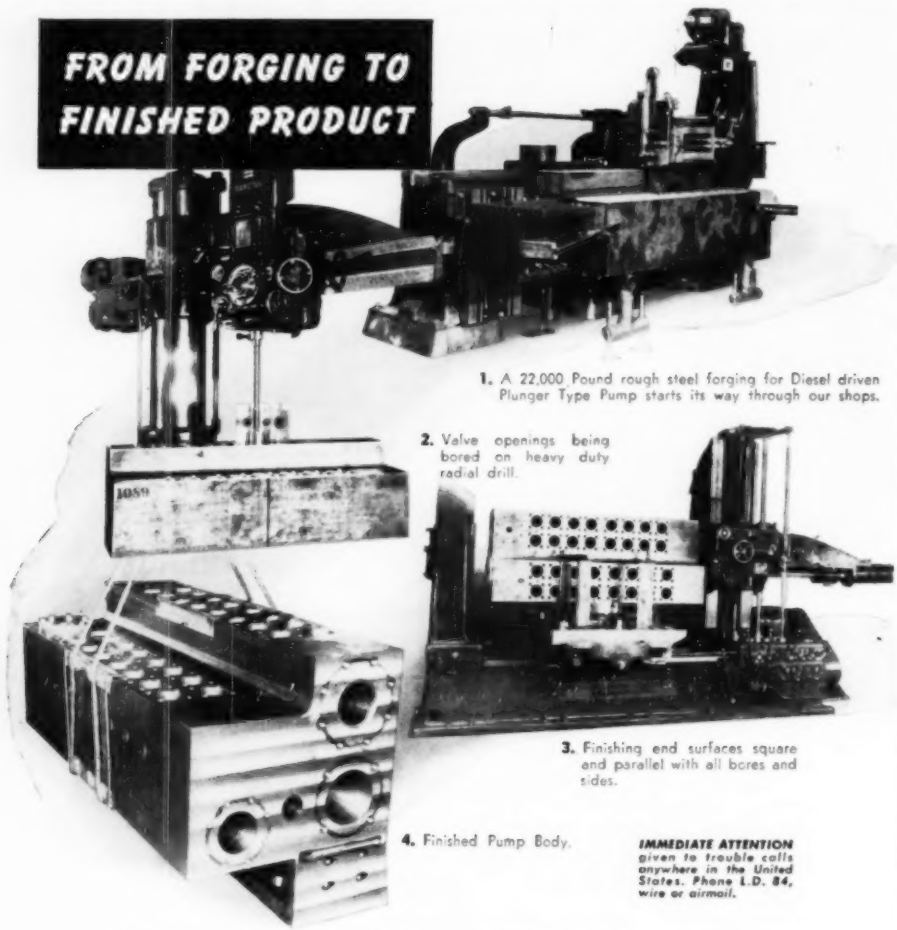
Bulletin 2902, describing the General Motors diesel mounting kits, will be sent upon request to Sperry Products, Inc., Danbury, Conn.

Now Oil-Coal Diesel Fuel Mixture

EXPERIMENTS started at North Carolina State College about two and a half years ago with engines given to the college by the Navy after a wartime training program have resulted in the development by Professor Robert B. Rice of the college's Diesel School of a high-speed diesel engine which burns pulverized coal mixed with its fuel oil. Rice said a 40-horsepower high-speed diesel is operating well on the coal mixture, producing nearly as much power as it would on straight fuel oil, and that a low-speed engine would use the mixture even better. The mixture is 45 per cent coal suspended in crude oil, and, according to Rice, does not clog the cylinders, although it tends to foul up the fuel system. Experiments are under way to determine if it causes extra wear in the engine.

Correction

IN an item describing the new Lima-Hamilton diesel electric switching locomotive, which appeared in the March issue of DIESEL PROGRESS, it was stated that starting tractive force, 25% adhesion, is 6,000 lbs., whereas the correct starting tractive force at 25% adhesion is actually 60,000 lbs. We regret this typographical error and are pleased to correct it in this manner.



1. A 22,000 Pound rough steel forging for Diesel driven Plunger Type Pump starts its way through our shops.

2. Valve openings being bored on heavy duty radial drill.

3. Finishing end surfaces square and parallel with all bores and sides.

4. Finished Pump Body.

IMMEDIATE ATTENTION given to trouble calls anywhere in the United States. Phone L.D. 84, wire or airmail.

Manufacturing is not our primary business—however, in order to completely recondition some heavy duty Diesel units promptly and expediently, we sometimes must fabricate complete items where factory parts are no longer available or where a change in material or design is desired by the customer.

Our shops are completely equipped with heavy duty and modern equipment. Call us on any Diesel repair or rebuilding job. In addition to our excellent shop facilities we maintain experienced crews with portable repair equipment for work anywhere.

"KEEPING PACE WITH DIESEL PROGRESS"

WASHINGTON IRON WORKS, INC.

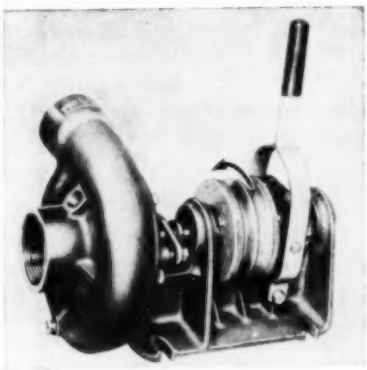
Established 1876

SHERMAN, TEXAS

Diesel Manual Revised to Reflect Current Practice

THE second and revised edition of John W. Anderson's book "Diesel Engines" was recently published by McGraw-Hill Book Company. Widely known throughout the diesel industry, the author of this practical manual for diesel engine operators has been identified with top engineering circles for almost as many years as the industry is old. Better than one-third of the book has been completely rewritten to bring it in line with modern developments and current practices, and the balance of the text has been extensively revised. This revised edition of the manual gives practical methods for keeping engines running efficiently and economically and shows how to avoid troubles and what to do about them when they arise. Mr. Anderson is known for his easy to read, easy to understand style of writing and his revised edition of "Diesel Engines" will be found most useful and helpful.

New Clutch Driven Pumps



Heavy-duty clutch driven pump

MARINE Products Company of Detroit announces a new, heavy duty line of clutch driven pumps in all bronze construction.

These sizes are for 1½" and 2" pipe. The range is up to 300 gallons per minute. Pressures at reduced flows are approximately 25 pounds.

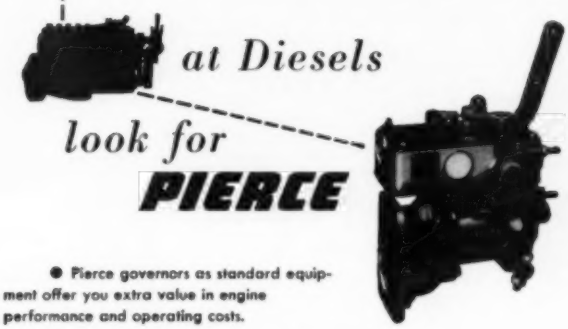
Model 3800 is a high efficiency, straight centrifugal, in right and left hand rotation. Model 3841 is a reversible pump and operates at slightly reduced efficiency in either direction of rotation. Model 3840 is a self-priming centrifugal model which will lift water 20 ft. without the necessity of filling the suction line with the fluid pumped.

The principal and unusual feature is the adaptation to a pump of the heavy duty, double disc clutch over the impeller shaft. The need for a compact pump and clutch unit has stemmed from persistent inquiries from the trade. This design has been recommended for use as a washing, coolant, flushing, de-watering, or agitating pump.

Engagement of the clutch permits immediate flow of a great volume of fluid. Disengagement of the clutch eliminates the necessity of stopping and starting the main drive motor when the use for the pump is no longer required.

When you look

at Diesels look for PIERCE



● Pierce governors as standard equipment offer you extra value in engine performance and operating costs.

1. The centrifugal principle of balanced counterweights gives exact control of engine R.P.M. to meet the varying conditions of any job. Engine protection is guaranteed.

2. Precision built, Pierce governors give trouble free operation—usually for the life of the engine.

3. Engine operation costs less with Pierce—better performance and less maintenance.

Many diesel engines are Pierce equipped. Pierce replacement governors to fit most engines are available through your local distributor.

Write to 1603 Ohio Avenue, or call Pierce Governor in Anderson, Indiana, for distributor name and complete information.

WHEREVER GOVERNING IS REQUIRED . . . PIERCE IS YOUR FIRST CONSIDERATION

PIERCE GOVERNORS

New Fuel and Lube Oil Filter Recharge Has Graduated Density

A NEW type of cellulose filter element, the NU-PAK recharge, has been announced by Wm. W. Nugent & Co., Inc., 410 North Hermitage Avenue, Chicago 22, Illinois. The recharge, made to fit existing Nugent filter shells, is graduated in density so that dirty oil being filtered passes into a large and coarse outer surface, then through a progressively smaller fibre structure, until at the center of the recharge, dirt and carbon particles as small as a few microns are removed. One of the recharge's advantages is claimed to be even dirt-loading, due to the long, irregular course the liquid must take to pass through the element.

NUPAK Recharge

Laboratory tests have been run with gasoline to determine the efficiency of the recharge in removing solid particles (Fibrene Dust Talc, .03% by weight) and water (.05% by volume, sprayed on the gasoline surface). Physical and chemical analyses of the filtered gasoline are said to have shown no traces of water, and no talc particles exceeding 3 microns in size. Only a few particles remained, and were of a size much less than 3 microns.

The NUPAK recharge is recommended for internal combustion engines where the liquids enter the filter at low viscosity. Full details are available from the manufacturer.

Gauge, Level Control and Alarm

A TRIPLE purpose, dial indicating, liquid level gauge containing a control for automatic tank refilling as well as high and low level alarm is a recent development of the Rochester Manufacturing Company, Inc., of Rochester, N. Y., makers of gauges for 35 years.

Primarily designed to greatly simplify tank and electrical connections in diesel day tank installations, it combines all three features of dial indication of tank level, automatic refilling control—and low and high level alarm in a single unit that mounts on a ¾ in. deep, 3⅝ in. diam. flange having 1⅝ in. tank opening and secured by only 4 mounting screws on a 3⅛ in. bolt circle.

A heavy duty relay in the box beneath the gauge translates the cam actuation of micro switches within the gauge head into heavier currents for the direct operation of fractional horsepower motors or solenoid controls for three phase operation.

Gauge is intended for mounting on tank horizontal centerline with float providing dial indication of tank capacity. Refilling control is usually set to cut in at the one quarter level and cut out at the three quarter mark. Alarm, when included, operates slightly below and above these normal extremes. Other settings supplied on order.

Wiring simplicity is emphasized by the fact that only three leads are brought out of the model having filling control only, two for connection to current source and the third for solenoid valve or pump motor or both. When alarm is included one additional lead is required.

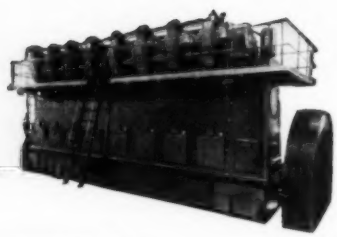
This gauge may also be employed to automatically maintain a required liquid level in a tank by employing it with blank head as a float switch with short float arm and mounted directly on line of desired level when a half inch drop will serve to actuate control.

Illustration shows Model 3272 Rochester Gauge and Level Control in lever action type with 140° fractional dial suitable for small tanks. Model 3272-C1 includes alarm. Model 3273 is gear action type with pointer travel of 300° for more accurate reading of tank contents in fractions or percentage of tank depth. Model 3273-C1 includes alarm.

before you buy a diesel!

The RPM at which it is designed to run is one of the most important points to check before you select any make of diesel. Why?

Because low speed operation means less vibration, less wear, less maintenance . . . and *less cost per year of service in the long run.* That is why slow-running, smooth-running FULTON Diesels are the choice of so many shrewd engineers who know *it pays* to compare!



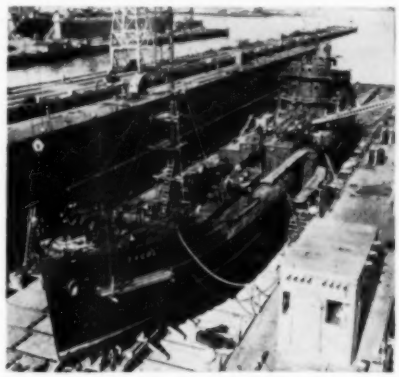
TYPE KS:
6 or 8 cylinders—1840 to 4000 HP at 240 to 257 RPM

TYPE BGS:
5, 6, 7 or 8 cylinders—750 to 1980 HP at 257 to 277 RPM

FULTON DIESELS . . . your best buy in the long run

FULTON IRON WORKS COMPANY
SAINT LOUIS 14, MISSOURI
New York Office: 82 Wall Street, New York 5

Tide Water Associated Acquires New Inland Tanker, Adds Tank Amidships



TYCOL after cutting and separating, ready for new tank construction.

A new 250-foot tanker, renamed the M. V. TYCOL, has been added to the East Coast Inland fleet of the Tide Water Associated Oil Company, it was announced today by R. K. Kelly, manager of the Company's Eastern Division Marine Department.

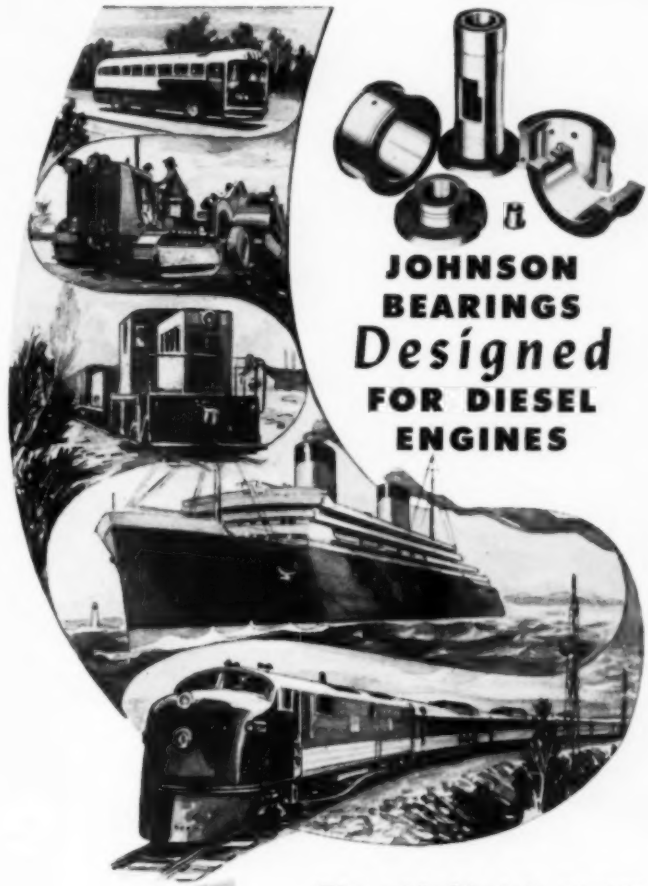
Formerly the M. V. OCHLOCKONEE, the tanker was purchased from the U. S. Government, and was overhauled at the Bethlehem Steel Company shipyard at San Francisco, where she had been laid up. Tide Water Associated removed her wartime gun placements and armaments and cut the ship in half to insert a new 3,000-barrel, 30-foot tank amidships. This increased the ship's capacity to approximately 15,000 barrels and her over-all length to 250 feet.

Additional specifications include a 37-foot beam, a draft of 12 feet seven inches, and a deadweight tonnage of 3,259. The motor vessel is powered by a single-screw Fairbanks-Morse diesel engine of 800 horsepower which develops a speed of 10 knots. The tanker, of modified T-1 design, was built in December, 1944.

She will carry a crew of 17 men and is expected to transport gasoline, kerosene and light fuel oils between Tide Water Associated's refinery at Bayonne, N. J., to the company's bulk terminals along the Hudson River as far as Albany, and Long Island Sound.

New Booklet, "Keeping On Schedule"

THE average railroad traveler little realizes the steady day-by-day maintenance and construction work that is being done by the railway industry in keeping pace with the great demand for speedier shipments and constant service. How these railroad crews strive to maintain the right-of-way over the nation's massive network of roadbeds is discussed with illustrations in a new Caterpillar Tractor Co. booklet "Keeping On Schedule." Copies of this publication may be secured by requesting Form 11797 from Caterpillar Tractor Co., Peoria 8, Illinois or by contacting "Caterpillar" dealers.



JOHNSON BEARINGS
Designed
FOR DIESEL ENGINES

You will find Johnson engineers willing to help you decide which type bearing is best suited and to design it to the application. Write, wire or call today!

The wide Variety of uses for diesel engines certainly demands specialized engineering. Each type of engine must be built for specific operating conditions. Likewise, the bearings, as well as other parts, need to be designed for the required load, shock, speed, temperature and other service considerations. Johnson Bronze furnishes the bearings for a majority of the diesel builders because, through extensive research and engineering cooperation, we have designed and produced the right bearings. Among the preferred types are aluminum alloy bearings and lead or tin base babbitt on either bronze or steel backs. Every Johnson bearing is made of quality material and finished to precise specifications.

Johnson Bronze
SLEEVE BEARING HEADQUARTERS
445 SOUTH MILL STREET • NEW CASTLE, PA.

Call JOHNSON BRONZE *at* ATLANTA • BALTIMORE • BUFFALO • CAMBRIDGE CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • KANSAS CITY LOS ANGELES • MINNEAPOLIS • NEW YORK • NEWARK • PHILADELPHIA • PITTSBURGH ST. LOUIS • SAN FRANCISCO • SEATTLE

NOW AVAILABLE

NEWLY REVISED BROUGHT UP TO THE MINUTE

13th edition of the DIESEL ENGINE CATALOG

THE ENTIRE DIESEL INDUSTRY UNDER ONE COVER

Whatever you are looking for in diesel engines, or accessories, you will find them described and illustrated in the 1948 DIESEL ENGINE CATALOG, Volume 13, edited by Rex W. Wadman. What's more, you will find complete specifications on

840 DIFFERENT MODELS

The Products of 53 Engine Manufacturers. Each engine description is complete and accurate—checked and double-checked by the Manufacturer himself. Illustrations include full page engine views, lube and fuel system diagrams, also cooling systems—many traced in color. But that is just the Diesel engine section. The Catalog also includes an accessory section carrying valuable information on the various Fuel Injection Sytems, Gear and Chain Drives, Turbochargers, Blowers, all fully described and profusely illustrated.

FOR DESIGN AND OPERATING ENGINEERS AND BUYERS

There is a Market Place Section—a directory of Diesel engines classified as to ratings and speeds with manufacturers' names and addresses—and a Product Directory including accessories, parts, materials and services—all classified as to products. The Market Place tells you at a glance where to find what you want for your engine or plant.

NO OTHER DIESEL BOOK LIKE IT
Really 4 Books In One

1. **The main section is devoted to descriptions, illustrations and specifications of all the Diesel engines manufactured in this Country.**
2. **A large section carries complete illustrated descriptions of Diesel engine and plant accessories.**
3. **The Market Place—a classified directory of Diesel Engines and Accessories.**
4. **Manufacturers' Advertisements—informative—helpful.**

REVISED ANNUALLY

The most widely-used Diesel reference book published:—Because the book is revised and brought up to the minute each year, thousands of design and operating engineers, purchasing and sales executives, Diesel students buy the DIESEL ENGINE CATALOG each year and constantly refer to it throughout the year. The 1948 Edition, Volume 13, embodies sweeping changes—new models and types, revised designs, and carries the basic information published in previous editions. Whatever your interest in Diesels is you will find this Edition of the DIESEL ENGINE CATALOG indispensable.

DIESEL ENGINE CATALOG
Two West Forty-Fifth Street, New York 19, N. Y.

Enter my order today for a copy of the 1948 Diesel Engine Catalog, Volume Thirteen. Edited by Rex W. Wadman, for which I enclose $10.00, also payable at £2 10s. 0d. to E. H. Doddrell, 342 St. Paul's Corner, Ludgate Hill, London E.C.4.

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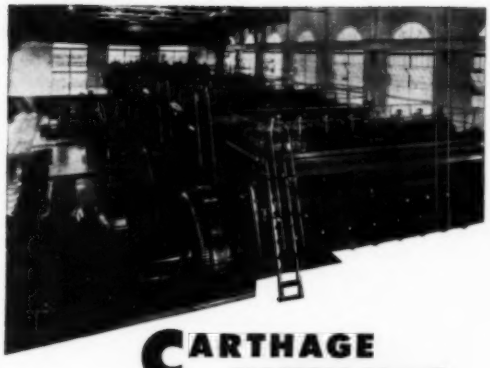

CARTHAGE ELECTRIC PLANT
specifies
another HONAN-CRANE PURIFIER

It was natural for Superintendent H. J. Williams to specify Honan-Crane oil purification on the new 3800 hp. diesel addition to the Carthage Water and Electric Plant in Missouri.

Past experience with Honan-Crane pointed the way, for Superintendent Williams reports Honan-Crane oil purification expense is low—is no factor in total operating costs.

For full information on low cost purification of diesel fuel or lube oils, write to Honan-Crane Corp., 202 Indianapolis Ave., Lebanon, Ind., subsidiary of Houdaille-Hershey Corp.

KODIAK of Vancouver, B. C.

Highline halibut boat of 1948. Powered by **UNION** Diesel built in 1927

The UNION DIESEL ENGINE Co.
2200 EAST SEVENTH STREET
OAKLAND 6, CALIFORNIA, U. S. A.

Just Out

Supercharging The Internal Combustion Engine

By E. T. Vincent
Professor of Mechanical Engineering
University of Michigan

323 pages, 6 x 9, 167 illustrations, $5.00

This book contains the essential fundamental theory of the various forms of superchargers and turbo-superchargers, together with a treatment of their effects on engine cycles, power outputs, and thermal efficiencies. The emphasis is on the fundamentals of the thermodynamics and mathematics involved in solving problems of supercharging.

SEE IT 10 DAYS FREE • MAIL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 18
Please send me a copy of Vincent—SUPERCHARGING THE INTERNAL COMBUSTION ENGINE for 10 days' examination on approval. In 10 days, I will remit $5.00, plus few cents postage, or return book postpaid.

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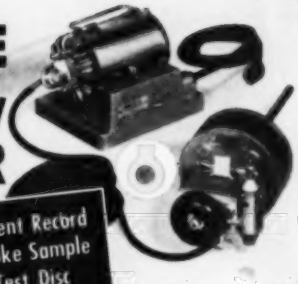
SMOKE Density METER



Makes a Permanent Record of an Actual Smoke Sample on a Paper Test Disc

☆ **Automatic operation from any 110-220 v. outlet. It is merely necessary to insert test disc, and flick the time control switch.**

☆ **Smoke deposit on test disc is an infallible measurement of the degree of smoke density, indicating even the slightest smoke changes.**

☆ **Shadings of smoke spots provide an accurate means of grading smoke readings, assuring precise, impersonal judgment of smoke conditions.**

☆ **Meter can be adjusted to practically any desired smoke density range by varying the sampling period between 30 and 90 seconds.**

☆ **Portable—furnished in steel carrying case—size 15" x 9" x 6".**

While this meter has been developed specifically for smoke measurements of oil burning equipment, it may be successfully used for sampling dust in the atmosphere and for other applications requiring knowledge of the concentration of particulate matter suspended in gas or air.

For complete particulars write for Leaflet 746.

BACHARACH Industrial Instrument Co.
7000 BENNETT STREET • • PITTSBURGH 8, PA.

THOMAS
Flexible ALL METAL
COUPLINGS

Engineered to stand up on the toughest jobs, Thomas Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.

The standard line of Thomas Couplings meets practically all requirements. But if unusual conditions exist we are equipped to engineer and build special couplings.

BACKLASH
FRICTION
WEAR and
CROSS-PULL
are eliminated
NO LUBRICATION
REQUIRED!

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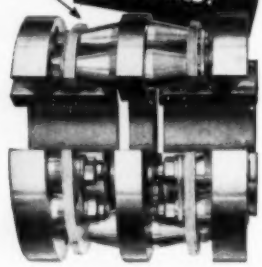
DISCS



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

Write for New Engineering Catalog

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

It's Going to Cost Billions!

By CHARLES M. UPHAM

Engineer-Director, American Road Builders' Association

IT'S going to cost billions to build our highways to meet transportation needs of today and tomorrow. It's going to cost about $60 billion according to authoritative estimates. This may prove conservative.

Last year we spent $1.8 billion on our highway construction program. This is a staggering sum; but when the conditions surrounding the expenditures are analyzed, it dwarfs into a fraction of what should be spent. In 1948 we spent for highway construction at the rate of $12 for every man, woman and child in the nation. These are small expenditures for a country that has come to depend so much upon its highway transportation system in influencing its national economy and setting its standard of living. The annual benefits coming from our highway system to all the individuals of the nation are many times greater than the $12 investment.

The expenditures of 1948 were just a little greater than that of 1930, even though our national income was five times greater than in 1930. Our increased population—25 million since 1930, together with new traffic demands—10 million vehicles in the last three years—and the large increase in the number of trucks and the additional mileage that all vehicles are travelling on our roads are definite demands for a speeding up of our investments in our highway program.

Thomas H. MacDonald, in his testimony before Congress, showed that our roads need surfacing at the rate of 40,000 miles per year. We need to build this amount to equal the roads that have worn out during the year—and we must build additional miles to bring our entire system to the condition of meeting the new demands that are coming on our highways and to replace the deficiencies caused by the non-construction program during the war.

The need for better highways is well illustrated by the revolutionary expansion of highway transportation since the end of the war. From a total of 30,475,000 motor vehicles registered in 1945, an increase of 10,475,000 in the following three-year period brought the total to 41,000,000 in 1948.

Vehicle mileage has increased from 249,000,000,000 (b) in 1945 to 395,000,000,000 (b) in 1948. Gasoline consumption and state income from gasoline taxes and registration fees have also skyrocketed. In fact, the only reason the uptrend in highway use is not greater was due to the inability of the manufacturers to produce more vehicles.

Trucks increased from 4,834,000 to 7,332,000, an upturn of 2,498,000. The expansion in the use of truck transportation is pointed up by the fact that ton-mileage nearly doubled during the three-year period—increasing from 55 billion ton-miles in 1945 to an estimated 100 billion ton-miles in 1948. The ratio of trucks and buses to passenger cars has increased from 1 to 28 in 1904 to 1-6.5 in 1930 and 1-4.5 in 1948. These figures indicate that actual *passenger-mile* and *ton-mile* figures must be used to measure highway construction costs in place of the old comparative *per-mile* costs.

Nor can we forget the rapid deterioration of our secondary road system over which the farmer transports his produce on the way to market. Of the 3,010,000 miles of rural roads in this country, more than one-fourth—817,000 miles—are primitive and unimproved and one-half—1,466,000 miles—are unsurfaced.

Another important function of our highways is their place in national defense. We are planning to spend $15,000,000,000 (b) for defense purposes this year. Good roads are a primary necessity to connect military installations with main arteries of travel whether they be highways, railroads, ports or airfields.

There is every reason now for accelerating our highway program to gear it to the needs of our present-day economy. It can be assumed that prices have reached a fair degree of stabilization, and the highway program should go ahead at full speed from here. Time lost at this stage means economic loss, even a reduced national income to the nation from lack of badly needed transportation facilities.

A.P.B.A. Sees Record Number of Regattas for '49

THE American Power Boat Association announced a preliminary list of 104 regattas and long-distance races, 48 one-day meets and 56 two-day contests, are being considered for sanction. The number may well double following official endorsement of events still tentatively scheduled. With 162 regattas and time trials having been sanctioned last year, C. King Brugman, president of the A.P.B.A., national governing body for motor boat racing, forecast a new record number of contests for 1949.

The forthcoming schedule, ranging from local lake races to such major programs as the President's Cup and Gold Cup Regattas, extends throughout the nation and includes 12 Canadian events, the last of which will be held during the Canadian National Exhibition at Toronto, September 7.

Engineering Controls Expands

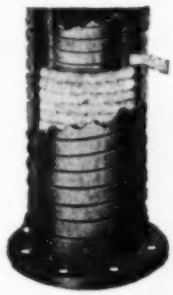
SUPPLEMENTING the recently announced appointment of A. Tacchella as Project Engineer, President L. C. Harbert of Engineering Controls, Inc., reports further staff appointments and general expansion.

Charles W. Lang, M.I.T. graduate, formerly identified with Enterprise Engine & Foundry Co., and Sterling Engine Co., assumes the post of Research and Development Engineer. Ralph A. Chamberlain joins the staff in the position of Sales Engineer. R. E. Douglas, Vapor Phase Engineer who has served in various capacities with this firm during the past three years, has been promoted to the duties of Assistant to the President.

Atlantic Metal Hose

For All Diesel Services!

RECOMMENDED for high quality performance by Engine Builders, Marine Architects, Industrial Designers and Engineers. Atlantic Flexible Metal Hose is supplied in various metals, diameters and lengths, including fittings. Sizes 3/16" to 36" ID are available. Ideal for Diesel Exhausts, Air Intakes, Fuel, Lube, Water and Air Lines!



Left, asbestos insulated, air-jacketed exhaust heat retaining hose. Below, Type SW, Diesel Exhaust. Absorbs vibration, expansion and contraction.

Ask for our Diesel Bulletin 1020

Atlantic Metal Hose Co., Inc.
102 W. 64th St., New York, N. Y.

YOU HAVEN'T HEARD

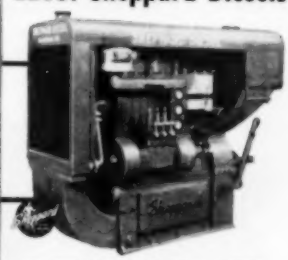
"THE half OF IT"

. . . until you hear about Sheppard Diesels

Sheppard Diesels consume HALF as much fuel per hour as gasoline engines

Sheppard Diesels run on any one of 15 fuels, most of which cost less than HALF the price of gasoline

Sheppard Diesels operate 3 to 5 times longer between overhauls —cut down-time by a lot more than HALF



45 H.P. 3 Cylinder Power Unit with power take-off and clutch. Also available as 2 to 36 K.W Generating Set

Get the WHOLE story of Sheppard Diesel economy, dependability and long life. Write today for 16-PAGE BOOKLET

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SHEPPARD DIESELS, HANOVER 8, PA.

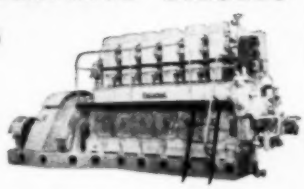
NEW ENTERPRISE DIESELS

MODEL DSG-6

FOR

IMMEDIATE DELIVERY

WITH



375 KVA, 300 KW IDEAL ELECTRIC CO. A.C. GENERATORS, 450 RPM

These units are offered at considerably less than the manufacturer's list prices. Write or wire today for complete information about these slow-speed fully-guaranteed Diesel units for your electric power requirements.

DIESEL PLANTS FROM 10 TO 1420 KVA
WHAT ARE YOUR REQUIREMENTS?

AG SCHOONMAKER CO INC.
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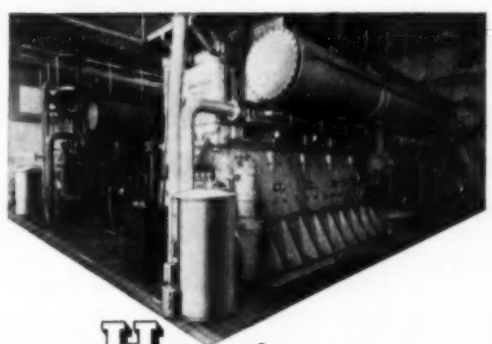


Hutchinson gets

DEPENDABLE OIL PURIFICATION

ON ALL SIX DIESELS at the Municipal Light & Power Plant, Hutchinson, Minnesota, Honan-Crane equipment delivers dependable oil purification.

Superintendent R. E. Young uses Honan-Crane purifiers on three 625 hp McIntosh-Seymours, two 3060 hp Busch-Sulzers, and one 1500 hp Nordberg, and maintains a fine record of continuous engine performance.

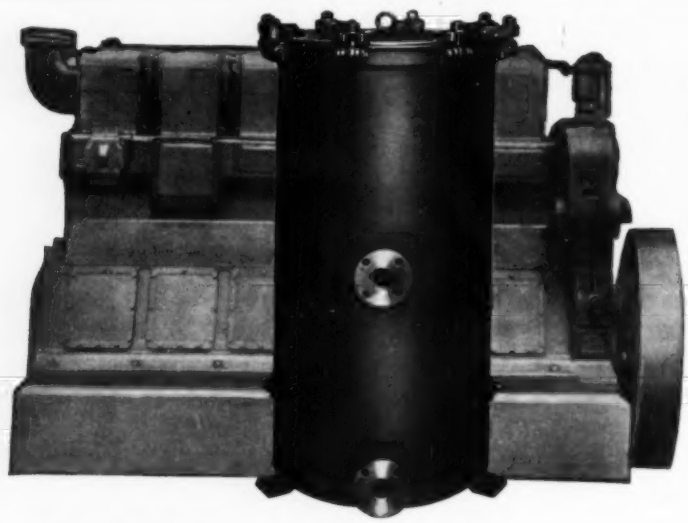
Let Honan-Crane engineers tell you about full purification of diesel fuel and lube oils at low cost. Write to Honan-Crane Corp., a subsidiary of Houdaille-Hershey Corp., at Lebanon, Ind.

Fairbanks-Morse Appoints Director of Personnel

L. R. Gaiennie

ROBT. H. MORSE Jr., vice president in charge of all operations, announced the appointment of Louis R. Gaiennie as Director of Personnel of Fairbanks, Morse & Co. Gaiennie, who will make his headquarters at the Beloit, Wisconsin plant of the company, will be available for consultation concerning personnel matters for all plants and branch houses of Fairbanks, Morse & Co. Before his appointment with the Fairbanks-Morse organization, Mr. Gaiennie was assistant to the vice president of Richardson Company. Well-known in the field of personnel work, he was at one time a staff consultant of Stevenson, Jordan and Harrison, Inc. Mr. Gaiennie will report directly to Robt. H. Morse Jr.

Order Your Copy of the 1948 DIESEL ENGINE CATALOG, Vol. 13 now. Thoroughly revised — more complete — indispensable. Convenient order coupon on page 78.



HERE'S HOW To Make Motor Oils Work Longer For You

There is no doubt that we in the U.S. carelessly use much more lubricating oil than is necessary—and therefore contribute to the overall oil shortage.

Reduce Consumption and Costs 40%

There is a simple method of reducing oil consumption, eliminating needless waste and at the same time cutting operating costs of motor vehicles.

Install Good Oil Filters

Oil is kept clean for much longer use. Oil changes will be needed less frequently. Besides you get better engine performance and eliminate premature wear, part replacements, and repair expense.

Install MICHIANA Filters,—selected by America's leading engine engineers and operators of fleets where exact records reveal the advantages of MICHIANA.

MICHIANA OIL FILTERS For Diesel Engines

MICHIANA PRODUCTS CORPORATION
Michigan City, Indiana

Request your copy of latest illustrated Bulletin 45-D today.

Swain Named Regional Manager by Koppers Piston Ring Department

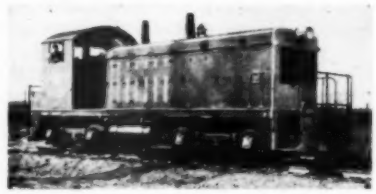
H. H. SWAIN, formerly Midwestern regional sales manager for the Thermoid Company and widely known in the automotive field, has been named Central States Regional Sales Manager for the American Hammered Piston Ring Department of Koppers Company, Inc., it was announced recently. Mr. Swain will manage automotive replacement, engine rebuilders, and fleet sales in four states—Illinois, Michigan, Indiana, and Wisconsin. His headquarters will be in Chicago. In addition to his duties as Regional Sales Manager, Mr. Swain will be a consultant to the sales management of Koppers Piston Ring Department.

Hydrion Water Demineralizer

THE Hydrion demineralizer provides a practical and simple means for converting ordinary tap water to the chemical purity of distilled water according to the manufacturer. The unit requires no heat or cooling or power in its operation. It utilizes a disposable cartridge and requires no attention while in operation. The Hydrion is an ion-exchange water purifier and can be used as a continuous flow unit or for intermittent demand. It consists of a replaceable cartridge, a wall-type cartridge holder and an electronic indicator for quality of treated water.

The cartridges are charged two synthetic ion-exchange resins. A cation resin removes the metallic ions such as calcium, magnesium, iron, sodium, and replaces them with hydrogen ions converting the mineral salts into acids. The other resin called the anion removes the acid. The manufacturer of Hydrion demineralizer recommends it for storage battery servicing and maintenance and for treatment of internal combustion engine jacket cooling water.

G.M. Builds Switchers In Cleveland Plant



The 100th General Motors switcher to be produced in Cleveland, a 1000 horsepower Diesel for the Union Railroad of Pittsburgh, rolled off the assembly line of Plant No. 3 of Electro-Motive Division on Friday, April 1. Switcher production was transferred from the La-Grange plant when Electro-Motive took over in 1948. The first Cleveland built locomotive was completed December 23.

New Sales Presentation

Sheppard diesel installed in tandem trailer.

THE R. H. Sheppard Company, Inc., is now featuring a novel sales technique that harks back to the principle of "bringing the mountain to Mohammed." Sheppard's factory representatives are equipped with a tandem trailer in which is mounted a 2 kw. generating set and a Sheppard one cylinder, air-cooled diesel engine. When calling on a prospective engine buyer the Sheppard salesman has much more to show than a photographic illustration or an engineering drawing of his product.

The buyer is asked to step just outside his office and inspect the actual diesel engine. By pressing the starter button the prospective buyer starts the engine thus lighting a bank of flood lights mounted on the trailer to supply a partial load for the generator.

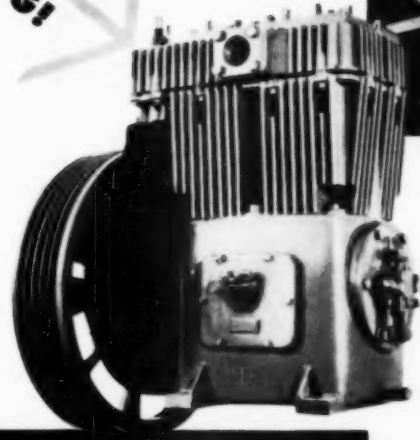
Sales Engineer for Cummins

Richard Keast

THE appointment of Richard Keast as sales engineer for Cummins Sales & Service, Inc., in the Dallas area has been announced by J. E. Everroad, recently elected president and general manager of the corporation. Keast will handle the sales of Cummins Diesel Engines from the Dallas office, located in the Magnolia Building.

His machinery experience includes nine years with Allis-Chalmers as a sales engineer at their factory and in Dallas; oilfield experience was gained as a member of the production and drilling division of the Rio Bravo Oil Co. of Houston.

NEW! BIG!



Quincy COMPRESSOR MODEL 390

ONLY QUINCY OFFERS ALL THESE FEATURES

- Aluminum Cylinders and Heads
- Lynite Rods
- Copper-finned Intercooler
- Perfectly Balanced Crankshaft
- Timken Main Bearings
- Positive Pressure Lubrication
- Authorized Service—nationwide

A COMPLETELY NEW COMPRESSOR DESIGNED TO MEET THE NEEDS OF THE DIESEL INDUSTRY

With the addition of Model 390, Quincy offers the most complete line of air compressors ranging in size from 1 to 90 c.f.m. Model 390 is a two-stage, air-cooled unit with a piston displacement of 90 c.f.m. For 250 lbs. non-intermittent pressure service. New design features provide greater over-all efficiency. Available in a variety of mountings — electric motor or gas engine drive. Quincy builds air compressors *exclusively*. Have a Quincy specialist help you select the correct type and size compressor to meet your requirements.

WRITE FOR DETAILS AND LATEST PRICES

QUINCY COMPRESSOR CO.

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Branch Offices: New York • Chicago • Philadelphia San Francisco • St. Louis

In HAND PUMPS...

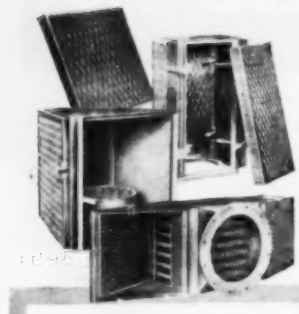
BLACKMER leadership is

Blackmer 210 . . . has won wide acceptance in fueling farm tools because of improved trouble-free design. Full 10 GPM at easy turning speed.

Performance PROVED!

In quality, dependability and service, Blackmer offers the finest rotary hand pumps that money can buy. The 404 is typical of their proved-in-use performance. Its smooth cranking action transfers all types of liquids in a full, non-pulsating flow. Blackmer "Swinging Vane" pumping elements are self-adjusting for wear. Self-priming, the 404 handles suction lifts up to 20 feet without a foot valve. It is designed for mounting on barrels, drums, underground and skid tanks. Blackmer hand pumps have proved their superiority in all types of applications all over the world. Other models are available for larger capacity or specialized requirements. Write for details.

BLACKMER PUMP COMPANY GRAND RAPIDS, MICHIGAN



FAR-AIR* FILTERS

Performance Leader in the **Railroad Industry**

Most of the major American railroads are standardizing on Far-Air Filters for diesel locomotive and car ventilation because they are *engineered* to effectively withstand the most severe operating conditions. The sturdy construction and *herringbone-crimp* design assures dependable higher performance . . . larger dirt holding capacity . . . lower pressure loss. . . . easier cleanability . . . reduced maintenance and replacement costs.

Among the users of Far-Air Filters are:

Atchison, Topeka and Santa Fe Railway Co.
Baltimore and Ohio Railroad Company
New York Central System
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Union Pacific Railroad

A well-equipped testing and development laboratory is maintained for research in all types of filtration problems. Farr engineers are available in your territory to serve you. Write Farr Company, Los Angeles 43, California.

FAR-AIR FILTERS

"Better by Farr"

*Trade Mark Reg.

FARR COMPANY
Manufacturing Engineers
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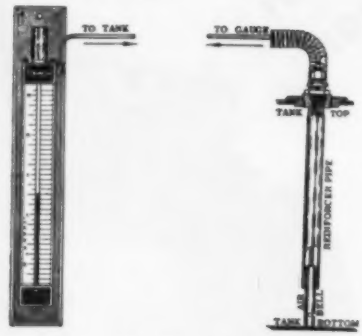
New Tank Gauge



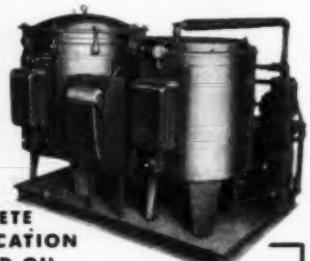
New Petrometer

AN improvement of a new liquid depth indicator is now in full production and distribution by one of the tank gauge firms, Petrometer Corp.' This non-mechanical instrument features an installation which consists of only one ¼" copper tube line with one compression connection at the gauge. It is suitable for all liquids stored in all types of tanks.

This gauge is constant reading and it is not necessary to aerate. However, a new principle aerater has been introduced to check the correctness of readings by clearing the transmission line. The instrument is approved by the Underwriters' Laboratories, and the Board of Standard and Appeals

More Roller Chain Distributors Appointed by Diamond Chain Co.

IN ORDER to make its roller chain, sprockets and flexible couplings more widely available from stock, Diamond Chain Company of Indianapolis has extended its countrywide coverage with the following additional firms appointed distributors: Akron, Ohio—Century Supply & Equipment Co.; Billings, Montana—Hines Bearing & Industrial Supply; Columbus, Ohio—The Ross-Willoughby Co.; Toledo, Ohio—Ralph Shawaker Co.; Kalamazoo, Mich.—Joseph E. Loughead Co.; Greenville, S. C.—J. W. Vaughan Co.; Erie, Penna.—Crossley Co.; El Paso, Tex.—The Mine & Smelter Supply Co.; Albuquerque, New Mexico—The Harry Cornelius Co.



FOR COMPLETE PURIFICATION OF USED OIL

The Hoffman Oil Conditioner saves lube oil by removing solubles and insolubles—saves centrifuge maintenance costs. Capacities of 50 to 600 g.p.h. Write for Bulletins A-667 and A-668.

U. S. HOFFMAN
MACHINERY CORPORATION
FILTRATION DIVISION, 212 LAMSON ST., SYRACUSE 6, N. Y.

Jacket Water Coolers Descaled Easily, Safely

The very next time lime scale accumulates on the watersides of your shell and tube type coolers, try removing these deposits with fast-acting Oakite Compound No. 32.

A scientifically inhibited acidic material, Oakite Compound No. 32 completely dissolves insulating lime scale and rust deposits.

You will find the widely-used Oakite descaling technique a safe, speedy way to restore heat exchange efficiency to your unit.

Free 28-page booklet contains details of application. Write today.

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Technical Service Representatives Located in Principal Cities of United States and Canada

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Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

25 KVA, 1200 RPM, A. C. Generator with Direct Connected Exciter.

COLUMBIA
GENERATORS
A.C. and D.C.

Columbia, with its years of experience, brings to you a wide line of performance proved, sturdily built, A.C. and D.C. Generators. A.C. Generators: 6¼ to 375 KVA. D.C. Generators and Exciters: 2 to 200 KW. Available in Single or Two Bearing Construction. *Write today for information. Our engineers will be glad to review your requirements. Prompt delivery.*

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., Cleveland 14, Ohio

Engineering Societies Meetings Scheduled

S.A.E. National Meetings

Summer Meeting	French Lick Springs Hotel	French Lick, Ind.	June 5-10
West Coast Meeting	Multnomah Hotel	Portland, Ore.	August 15-17
Tractor Meeting	Hotel Schroeder	Milwaukee, Wis.	Sept. 13-15
Aeronautic Meeting and Aircraft Engineering Display	The Biltmore Hotel	Los Angeles	Oct. 5-8
Diesel Engine Meeting	Chase Hotel	St. Louis, Mo.	Nov. 1-2

A.S.M.E. National Meetings

Semi-Annual	Univ. of Cal. Extension Bldg.	San Francisco, Cal.	June 27-30
Fall Meeting	Lawrence Hotel	Erie, Pa.	Sept. 28-30
Annual Meeting	Hotel Statler	New York, N. Y.	Nov. 27-Dec. 2

New Supercharged Cummins For Automotive Field

A new supercharged Cummins diesel engine for automotive applications has been announced by Cummins Engine Company, Inc. The newest addition to the Cummins line develops 225 hp. at 1800 rpm.

This diesel engine has a 5⅛" bore and a 6" stroke, with piston displacement of 743 cubic inches. Like all Cummins diesels, it employs the four-stroke cycle principle of operation, and the Cummins fuel distribution and injection system.

Other mechanical features include standard two-valve heads, continuous groove main bearings, increased flow lubricating system, buttress-type oil pan and flywheel housing, a newly-designed lubricating oil cooler and a Roots-type oil blower.

Booklet on Nordberg Engine

NORDBERG Manufacturing Co., Milwaukee 7, Wis., announces publication of Bulletin 165 on a Nordberg Type 4FS-1 four cycle, one-cylinder, 4½" x 5¼" Diesel engine.

This 4FS-1 engine has a rating of 10-15 HP at operating speeds of 1200-1800 RPM. It was developed to meet the need for a simple, compact, dependable engine capable of continuous heavy duty service.

New Tools You Should Have for **PRESSURE RESEARCH**

Now . . .

A SPARK PLUG ADAPTER

FOR PRESSUREGRAPH PICKUP

THAT MOUNTS IN A STANDARD SPARK PLUG PORT

Combining a spark plug and a pressuregraph pickup, the NEW SPARK PLUG ADAPTER makes it possible to run dynamic pressure tests without interrupting the firing of a single cylinder—and without the drilling of special holes.

Utilizing the spark plug as an integral part of the unit, the Adapter can be screwed into a cylinder head as simply and quickly as an ordinary spark plug. The Adapter comes in either 14 or 18 mm size, with both spark plug core and diaphragm easily interchangeable. Will fit any Model 3709-B Pressuregraph pickup now in operation.

IT'S FOR YOU

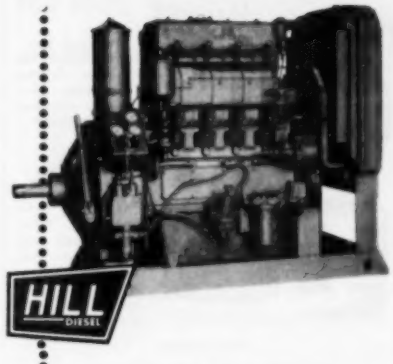
Write today for free booklet of electronic methods for measurement of pressure and displacement, showing photographs of pressure curves obtained under dynamic conditions in engine research.

Use of this new Adapter provides increased efficiency and convenience in running pressuregraph tests, and also permits checking of standard automotive, marine and aircraft engine performance without the special handling usually required by other test methods.

ELECTRO PRODUCTS LABORATORIES

549 W. RANDOLPH ST. **CHICAGO 6, ILL.**

℞ for Diesel Power FOR LONG LIFE



12 to 60 H.P.

Hill "R" Series Engines can be depended upon for long life and trouble free operation. Modern and efficient they are solid injection full Diesels that start cold directly on Diesel Oil.

Available in 2, 4, and 6 cylinder models the "R" Series delivers from 12 to more than 60 horsepower.

The "R" series includes Power Units, Electric Generating Sets, and Marine Propulsion engines, as well as Marine Auxiliary Units. Standard equipment includes all accessories necessary for operation except starting batteries.

Hill engineers are always at your service . . . ready to study and answer your power application problems. You incur no obligation in requesting information.

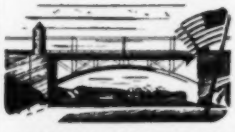
Write Dept. D

HILL DIESEL ENGINE
DIVISION OF
DRAKE AMERICA CORPORATION
20 East 50th Street, New York 22, N. Y.

SHIPPING

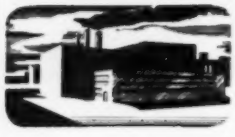
Ruggedly constructed Cunningham Air Whistles are most effective for all types of shipping.

BRIDGES



For Railroad and Highway Bridges Cunningham Air Whistles effectively signal traffic.

INDUSTRIAL AND MUNICIPAL



For Time and Emergency - Warning Signals the Cunningham Air Whistles, singly or in multiple combinations are sharply audible.

CUNNINGHAM AIR WHISTLES

4200 West Marginal Way **Seattle 6, Wash.**

Catalog & Information on Request

Cast Bronze Construction
Sizes For All Uses.

32 Years Experience in the Design and Manufacture of Whistles

SURPLUS DIESELS STILL BIG AID TO $ WISE BUYERS

Mr. $ Wise — There's a wonderful stock of low cost, factory new and gov't surplus diesel equipment waiting for you at BFM — Your "Supermarket for Power".

Write BFM today—

BENJAMIN'S FOR MOTORS
2090 Mill Avenue
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LST LSM LCIs
(Equipment off 15 vessels)
600, 900, 1800 HP DIESELS Complete
Winches—Diesel Generators
New 2x1 Reduction Gears for 1800 HP
WOOLDRIDGE BROKERAGE CO.
Box 54, Jeffersonville, Ind. Phone 2-2283

HERCULES DIESEL
LOW PARTS COST
INVENTORY CLOSE OUT
SCHENECTADY RY. CO., Schenectady, N. Y.

WEST COAST DIESEL NEWS

By FRED M. BURT

NATIONAL Iron Works, largest iron and steel fabricating concern in San Diego, has become National Steel & Shipbuilding Corp., C. Arnholt, Pres. stating that the name more truly portrays the character of the business. Since V-J Day the company has built 11 diesel-powered tuna clippers including the "National" series, all-welded steel, the latest and largest of which is the *Coral Virginia*, 115′ long, propelled by a 600-hp. Atlas Imperial.

DESIGNED by Art DeFever, built by Tacoma Boatbuilding Co., 87′ tuna clipper *Conqueror* for Skipper John Rippo, has for main power a 330-hp Washington Diesel; auxiliaries twin Pacific Diesels developing 144-hp at 900-rpm, (driving 75-kw generators) delivered by J. T. Siler Co., Wilmington, Calif.

PROBABLY the nearest to a 100% diesel owner organization that can be found is the American Tunaboat Association, San Diego; Manuel G. Rosa was elected president to succeed Anthony D. Madruga for a one year term; Wm. A. Hoss, vice-president and Louis DeFalco, Secy-Treas., both re-elections. Rosa's fabulous clipper *Lusitania*, built in the 20's was the second clipper built.

TEN Autocar trucks powered with Cummins NHB-600 diesels, 200-hp at 2100-rpm, delivered to W. D. Hall for his sand and gravel business in Aubuquerque, N. M., by W. M. Barnard, same city.

IN HIS fishing boat *Miss California*, owner Fred Foster, Montalva, Calif., by Chaffee Machine Co., San Diego, installation of new General Motors 671 main diesel engine, and 371 GM auxiliary, complete conversion to diesel electric.

BUILT by Pacific Boatbuilding Co., Tacoma, new 100 tuna seiner *Equator* delivered to Capt. Nick Trutanich, has for propulsion an 8-cyl. 12 x 15, 525-hp, Enterprise diesel; auxiliaries three 100-hp G. M. diesels.

A. TACCHELLA previously for several years in charge of West Coast operations for Busch-Sulzer Co., has joined Engineering Controls, Inc. (of Los Angeles and New York) in Los Angeles as Project Engineer; Ralph Chamberlain is a new Sales Engineer of wide experience; Hans Bohuslav, previously

IN COMBATING unprecedented weather conditions through seven consecutive weeks, Union Pacific Railroad in Western Nebraska, Wyoming, Idaho and Utah, used 14,000 "snow-fighters" to man great quantities of railroad-owned and leased equipment, including 124 flame-throwers and 180 bull-dozers, carry-alls, etc., mostly diesel-powered, and diesel units supplemented steam locomotives on 15 railroad rotary plows and 33 railroad wedge and spreader plows.

THE FIRST General Motors Torque Converter used in this western territory, with a 148-hp GM diesel, went to Enterprise Oil Co., Bakersfield, in a well-servicing unit, from Anderson-O'Brien, Los Angeles, via E. A. Bender, oil rig builder of Bakersfield.

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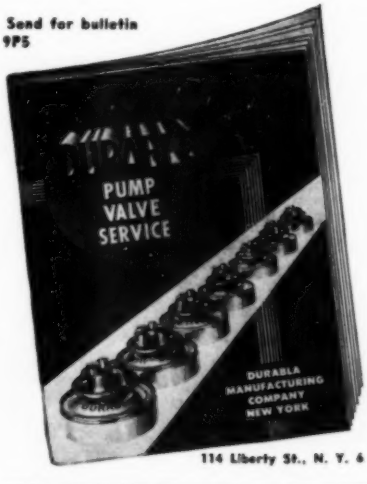


114 Liberty St., N. Y. 6

vice president has joined R. G. Le Tourneau, Inc., in Longview, Texas, as Chief Engineer of Engine Construction.

IN ADDITION to installing a new 560-hp. Fairbanks-Morse diesel for propulsion in the big tuna clipper *Olympic*, Harbor Boat & Yacht Co., San Diego, is completely rebuilding the boat from deck up as part of the post-season complete overhaul program.

THE FOURTH Annual San Francisco Sports, Travel & Boat Show will be held in the Civic Auditorium, April 22-May 1; under auspices of Associated Boat Industries of Northern California—the major boat builders, dealers, distributors, and marine supply firms. There will be a big showing of diesel and allied equipment. Attendance of 147,000 last show.

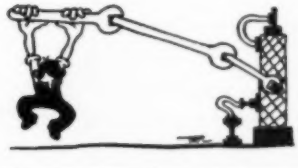
CROFTON Diesel Engine Co., of San Pedro, California, manufacturers of "Crofton" 5 and 10-hp diesel engines, (also GM engines, sales, service), has recently enlarged their engine manufacturing space to a total of 10,000 square feet.

AT CAMPBELL Machine Co., San Diego, a new 200-hp. Atlas auxiliary diesel connected to a 150-kw. generator was installed in tuna clipper *Conte Bianco* to increase power; 75-kw. set previously used.

SUPPLIED to the De Lair Truck Co., Los Angeles, by Cummins Service & Sales, the first Model HRBS-600 225-hp at 1800-rpm, supercharged, 6-cyl. Cummins diesel, in this area, to power a Peterbilt truck, replacing a Cummins HB-600, 150-hp diesel.

IN THE Bay Area—General Motors Electromotive Division has purchased 25,000 sq ft adjoining building to expand warehouse and manufacturing; American Tractor & Equipment, Oakland, is adding 7,000 sq ft to manufacturing facilities; and Parker Diesel Engineering Co., Oakland, is expanding shop facilities by 2500 sq ft.

SUPPLIED to Pioneer Drilling Company, Bakersfield, a complete "Ideal" drilling rig by National Supply Co., Los Angeles, powered by three GM twin diesels, of 260-hp each engine, from Anderson-O'Brien, Inc., Los Angeles.



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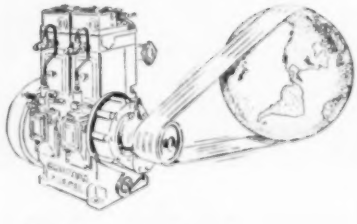

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San Diego, California

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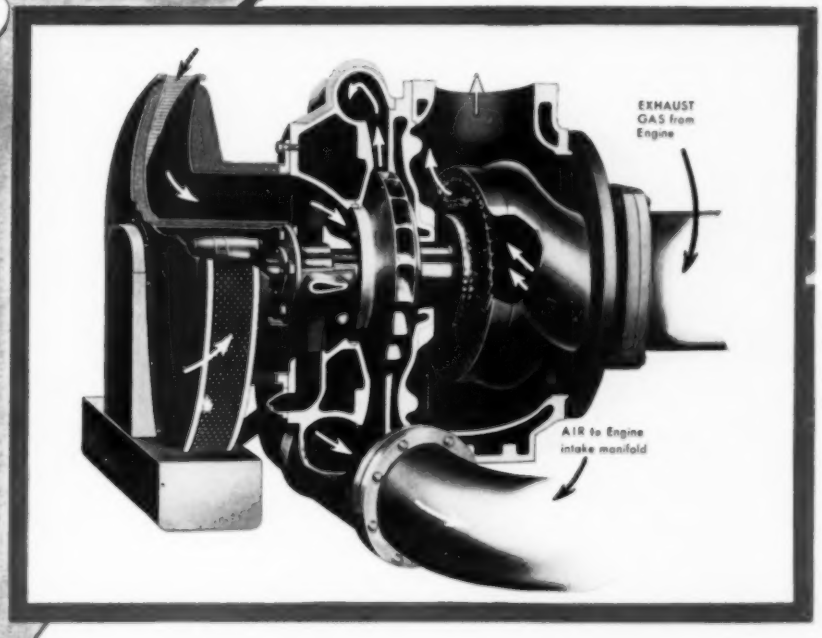
up where the air is THIN



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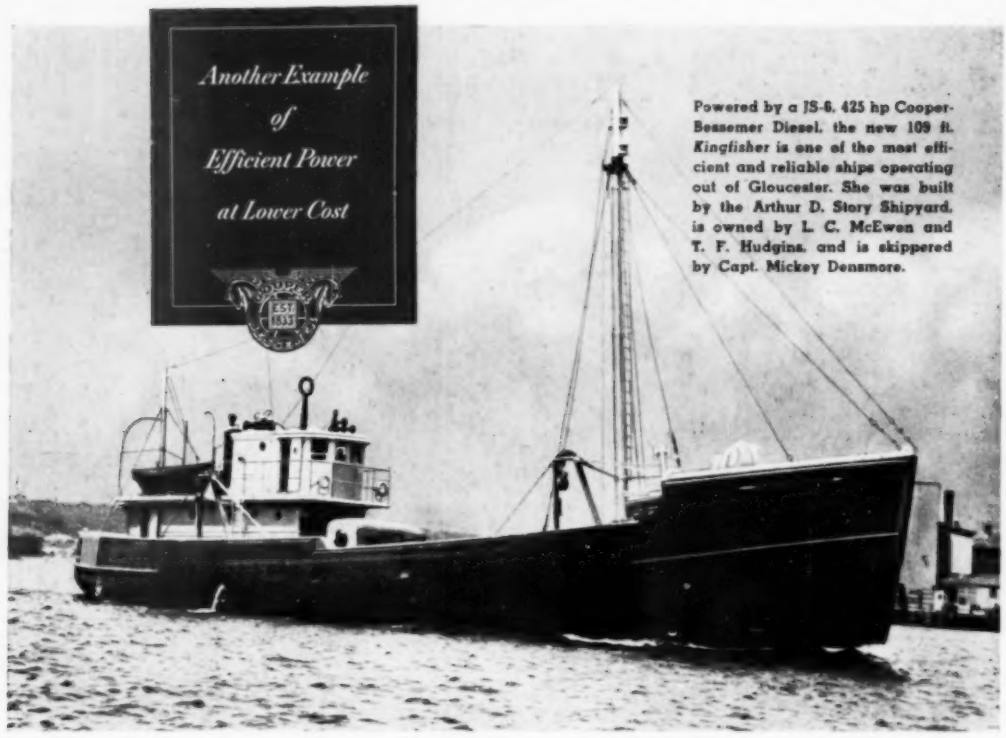

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